UCRL-AR-144636

LLNL Chronic Beryllium Disease Prevention Program (CBDPP) Implementation of 10 CFR 850

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August 8, 2000

DISCLAIMER

This work was performed under the auspices of the U. S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under Contract No. W-7405-Eng-48.

LLNL Chronic Beryllium Disease Prevention Program Implementation of 10 CFR 850

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Executive Summary

Beryllium work at LLNL is presently being done under the auspices of its DOE/DP approved implementation plan for DOE N440.1.[1] LLNL has a beryllium control program of long standing, 10 CFR 850 will require changes in how beryllium is controlled. The Rule establishes January 7, 2002, as the deadline for full compliance; LLNL considers full compliance to mean that all aspects of the Rule are actively being implemented.

The following list of action items is required to bring the LLNL program into compliance with the Rule:

Specific Implementation Requirements

- Perform "initial monitoring" for operations that may have airborne beryllium
- Prepare baseline inventory and perform hazard assessments in all former beryllium work areas
- Implement the required housekeeping program
- Establish database for information required by the Beryllium Registry (guidance is required from the DOE on specific data elements)
- Develop a program review plan

Revisions to Medical surveillance Program

- Update the beryllium medical surveillance program
- Implement the DOE-required consent form
- Review population at risk for consistency with the Rule
- Implement OSHA reporting protocol for beryllium health effects
- Formalize counseling program for sensitized and CBD-diagnosed workers

Revisions to the ES&H Manual

- Chapter 10, "Personal Protective Equipment," revision in progress; needs to be completed [Note: Approved 5/30/00 and available on-line at http://www-r.llnl.gov/es_and_h/ .]
- Supplement 21.10, "Safe Handling of Beryllium and Its Compounds," major revision required to reflect requirements of the Rule (engineering controls, administrative controls, and personal protective equipment)
- Revise ES&H Manual, Volume III, Chapter 9 for beryllium waste

Training Program Revisions

- Complete instructional design of new Beryllium Worker Class
- Complete instructional design of Beryllium Worker Refresher Class
- Complete instructional design of new Beryllium Awareness Class (for all LLNL employees other than beryllium workers) [Note: Complete 7/10/00 and available on line at http://www-training.llnl.gov/training/ .]
- Train all employees (LLNL and contractor)
- Formalize counseling program

Policy Revision

- Revise interim medical protection guideline to be consistent with the Rule

[1] LLNL Beryllium Disease Prevention Program, January 14, 1998.

Revision to IH Program and Policy Documents

- Revise IH DAP element for monitoring beryllium work areas
- Revise IHPIM for reporting results of exposure measurements

The timeline for completing these action items is provided in Appendix D.

Department of Energy Approval

Department of Energy
Oakland Operations Office
1301 Clay Street
Oakland, California 94612-5208

SEP 6 2000

Dr. C. Bruce Tarter
Director
Lawrence Livermore National Laboratory
P.O. Box 808, L-001
Livermore, CA 94550

Subject: Chronic Beryllium Disease Prevention Program Plan Approval

Dear Dr. Tarter:

As required, the Department of Energy (DOE) reviewed your Chronic Beryllium Disease Prevention (CBDPP) Plan, dated April 6, 2000, Rev. 2 (8/3/00), to determine its adequacy and conformance with DOE 10 CFR 850 Chronic Beryllium Disease Prevention Program Rule requirements.

This version of your CBDPP with its planned actions adequately addresses all rule requirements. The deadline for compliance with all rule requirements is January 7, 2002.

Please provide our Industrial Hygiene Functional Area Manager, Mr. Harvey Grasso, quarterly updates on the completion of action items. He can be reached at (925) 423-7557, facsimile (925) 423-6727, or E-mail Harvey.Grasso@oak.doe.gov.

Sincerely,

Martha J. Dorsogna

for Camille Yuan-Soo Hoo
Manager for National Nuclear
Security Administration Operations

cc: George Fulton, LLNL

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I. Introduction

Beryllium work at DOE and DOE Contractor sites is subject to 10 CFR 850, "Chronic Beryllium Disease Prevention Program."[2,3] For convenience, the full text of the Rule is provided as Appendix A. This Rule is applicable to LLNL subject to the following exceptions specified in the noted sections of the Rule:

1. Beryllium articles. (10 CFR 850.2(b)(1))
2. DOE laboratory operations that meet the definition of laboratory use of hazardous chemicals in 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemicals in Laboratories. (10 CFR 850.2(b)(2))

"Beryllium work" is the term LLNL uses to be synonymous with the Rule's term "beryllium activity." This is a direct consequence of the LLNL implementation of Integrated Safety Management and its focus on work and hazards.

"Beryllium" is very narrowly defined and includes only a small group of materials: elemental beryllium (i. e., beryllium metal), insoluble beryllium compounds, beryllium alloys and only where the amount of beryllium exceeds 0.1% by weight. A few examples of beryllium compounds and the applicability of the Rule are in the following table:

Compound	Solubility[4]	10 CFR 850 Applicable?
Beryllium acetate	Insoluble	Yes
Beryllium acetate (basic)	Slightly soluble, decomposes	No
Beryllium benzenesulfonate	Very soluble	No
Beryllium halides (Br, Cl, F)	Soluble	No
Beryllium hydride	Decomposes	No
Beryllium oxide	Insoluble	Yes
Beryllium sulfate	Insoluble in cold water; decomposes in hot water	Probably; generalization is not possible, a review of the specific use is required
Beryllium sulfate hydrate	Soluble	No

The definition for "article" is provided in the OSHA Hazard Communication Standard[5] and interpretation on how to apply it is in the OSHA compliance instruction for its

[2] 63 FR 66940-66975, "10 CFR 850; Chronic Beryllium Disease Prevention Program, Proposed Rule"
[3] 64 FR 68854-68914, "10 CFR 850; Chronic Beryllium Disease Prevention Program; Final Rule"
[4] David R. Liode, editor, *CRC Handbook of Chemistry and Physics*, 72nd edition
[5] 29 CFR 1910.1200, "Hazard Communication"

enforcement[6]. The definitions for "laboratory" and "laboratory use of hazardous chemicals" are given in the OSHA standard for exposure to hazardous chemicals in laboratories.[7] Guidance to OSHA's intent in defining a laboratory is available in the preamble to the final rule[8].

Beryllium work at LLNL is regulated by 10 CFR 850 and 29 CFR 1910.1450 (for work that is excepted under 29 CFR 1910.1200). This implementation plan only addresses 10 CFR 850. Those facilities and laboratories subject to 29 CFR 1910.1450 are covered by *Environment, Safety, and Health Manual (ES&H Manual)*, Volume II, Part 2, "Chemicals," specifically H&S Manual Chapter 21, "Chemicals," and H&S Manual Supplement 21.01, "Chemical Hygiene Plan."

This CBDPP shall be submitted to the Head of DOE Oakland (DOE/OAK), as required by 10 CFR 850(b), for review and approval. The CBDPP will be submitted to DOE/OAK annually for review, or earlier if there is a significant change in or addition to the CBDPP, or if there is a change in contractors.

Copies of the CBDPP are available upon request to the DOE Assistant Secretary for Environment, Safety, and Health or designee, DOE Program Offices, and affected workers or their representatives.

Covered Locations and Workers

This CBDPP covers work managed by LLNL at the Livermore Main Site, Site 300, and the Nevada Test Site. Other locations off-site are included in the CBDPP if the work is managed by LLNL.

All LLNL employees (i. e., a person hired and employed by the University of California to work at LLNL) who may be exposed to beryllium in the course of their work are covered by this CBDPP.

The employees of contractors, and other non-LLNL entities, who are directed or supervised by LLNL employees and who may be exposed to beryllium in the course of their work at LLNL are covered by this CBDPP subject to the constraints of the *ES&H Manual*[9, 10].

The LLNL Supplemental Labor Policy states (in part):

> **Supplemental Labor Workers.** The supplemental labor policy states that specific subcontract provisions must be in place to allow for work with a

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[6] OSHA Compliance Instruction, CPL 2-2.38D, "Inspection Procedures for the Hazard Communication Standard"
[7] 29 CFR 1910.1450, "Occupational Exposure to Hazardous Chemicals in Laboratories"
[8] 55 FR 3300-3335, "29 CFR Part 1910; Occupational Exposures to Hazardous Chemicals in Laboratories; Final Rule"
[9] *Environment, Safety, and Health Manual*, UCRL-MA-113867, Volume I, Part 2, "ES&H Management Requirements," specifically "Laboratory and ES&H Policies, General Worker Responsibilities, and Integrated Safety Management," section 1.5.2, "Non-LLNL Personnel"
[10] *Environment, Safety, and Health Manual*, UCRL-MA-113867, Volume II, Part 3, "Construction / Maintenance / Mechanical Equipment / Working Surfaces,", specifically "Procured Services Subcontractor Environment, Safety, and Health Program"

likelihood of exposure to substances not generally encountered in similar work in the relevant job category in U.S. industry.

Thus a contract modification may be required before work with beryllium by supplemental labor can commence. Specific details are available in the LLNL Supplemental Labor Policy Manual.

For work that is not supervised or directed by LLNL, the contractor will require a separate CBDPP. This plan will be approved by LLNL and submitted as an appendix to LLNL CBDPP for approval by the DOE.

Collective Bargaining and Labor Organizations

Presently there is one group of employees at LLNL working under a collective bargaining agreement. The agreement is between the Security Police Officers Association and the University of California. The relevant clause of the contract is:

> Article 9. It is further recognized by the parties to this Agreement that Department of Energy Regulations are the basic authority for establishing and continued implementation of medical/physical/mental standards for employees. Copies of directives regarding implementation or changes thereto will be made to the Association.

General Requirements (10 CFR 850.11)

Appendix C summarizes current and planned beryllium operations that are under the scope of this Plan. Integration of the Plan into the LLNL ES&H Program is discussed generally in the following section, and in detail in Sections II through XX of this Plan.

This CBDPP, the referenced documents of this Plan, and identified changes, establishes the Laboratory's commitment and the formal program to:

- Minimize the number of workers exposed or potentially exposed to beryllium
- Minimize the opportunities for workers to be exposed to beryllium
- Establish an exposure reduction and minimization program, commensurate with the risk

The requirement of the Rule (10 CFR 850.11(b)(3)(iii)) to minimize disability and lost work time due to chronic beryllium disease, sensitization, and associated medical care is an existing program that applies to all hazards. This is the Return-to-Work Program established in Appendix C of "Occupational Medical Program."[11]

Implementation (10 CFR 850.12)

No beryllium work subject to 10 CFR 850, outside the scope of this CBDPP, may be done unless an addendum to this CBDPP is written and approved by the DOE. DOE/OAK has 90 days to approve any submittal under the Rule; unexpected situations

[11] *Environment, Safety, and Health Manual*, UCRL-MA-113867, Volume IV, Part 1, "Occupational Medical Program"

may proceed without an update to the CBDPP, but only with the approval of the Manager of DOE/OAK.

Work outside the scope of this CBDPP is work that is a significant change or addition to that identified in Appendix C, "Current Beryllium Operations." There are no predetermined criteria to determine if a change is "significant" and a change to the CBDPP is required. Factors to be considered to determine if a change to the CBDPP is needed are:

- Mission changes
- Medical surveillance findings
- Performance indicators
- Administrative considerations

Notification to the DOE of significant changes, additions to the work, or if there is a change in contractors identified in Appendix C shall be as follows:

1. The program proposing the activity shall notify the cognizant ES&H Team who shall review the work.
2. The ES&H Team shall consult with the Hazards Control Department, Technical Support and Policy Development Division to determine if the proposal work is a significant change.
3. The change, if deemed to be significant, shall be forwarded to DOE/OAK, through the Livermore Site Operations, for approval.
4. The record of review and any required changes shall be maintained with the CBDPP in the Hazards Control Department, Technical Support and Policy Development Division.

Compliance (10 CFR 850.13)

Full compliance with all provisions of the Rule is required no later than January 7, 2002.

Integration of the CBDPP into the LLNL ES&H Program

This document, the LLNL CBDPP, is not a stand alone document or program, rather it identifies those portions of the LLNL ES&H program, when viewed as a whole, are integrated into the LLNL worker protection programs as required by parts 10 CFR 850.1 and 850.11 of the Rule. The Referenced documents that constitute the program are:

ES&H Manual Volume I: ES&H Management
ES&H Manual Volume II: Health & Safety Hazards and Controls
ES&H Manual Volume III: Environment Hazards and Controls
ES&H Manual Volume IV: Other Institutional ES&H Documents
Hazards Control Manual
Health Services Department Policies
Industrial Hygiene Discipline Action Plan
Industrial Hygiene Policy and Information Manual
LLNL Contract 48, Appendix G
LLNL Records Management Program
Waste Acceptance Criteria

The specific sections of these documents that apply to the control of beryllium exposure are identified in Sections II through XX of this CBDPP.

II. Baseline Beryllium Inventory (10 CFR 850.20)

Appendix B identifies buildings at the LLNL Main Site and Site 300 where beryllium work has been done from 1962 to date. The basis for this list is the historical record of air and surface sampling (as little as one air or surface sample will cause a building to be listed). All buildings are listed regardless of the number of samples taken; however, this historical record provides little information in many cases of the nature the work. "Beryllium work" is taken in a very broad sense; if a beryllium sample (air or swipe) was taken, "work" is presumed to have been done in the absence of other information. The number of samples taken is used as a surrogate measure of the amount of work done.

Based on this approach, the majority of beryllium work was done in the following programs:

Engineering
Chemistry and Materials Science
Machine Shop for Toxic and Radioactive Materials
Lasers
Hazardous Waste Management (formerly Decontamination Facility)
DUS Salvage Yard[12]
S-300 Firing Bunkers

This building list is the starting point for the baseline beryllium inventory. Assessment of hazard, if any, and documentation is addressed in Section III, "Hazard Assessment."

The beryllium inventory will be managed under the direction of the Industrial Hygiene Technical Leader[13].

Action Required:

(1) Conduct a Baseline Beryllium inventory by:
- Reviewing ES&H building files.
- Review sampling data and conducting air, surface, and bulk sampling, as appropriate.
- Gathering historical knowledge of building occupants and program management to identify specific programs, locations, and operations where beryllium work has been done.
- Documenting the characteristics and location of beryllium in facilities.

[12] Contaminated equipment should not be present in the Salvage Yard; samples were routinely taken to verify absence of contamination. Contamination was occasionally found on equipment, however.
[13] See Hazards Control Department Posting "Industrial Hygiene Technical Leader," 3/21/97. Incumbent is required to be a certified industrial hygienist.

III. Hazard Assessment (10 CFR 850.21)

Hazard assessment is subdivided into two categories:

1. Existing operations
2. Historical operations as identified in the baseline inventory (see Section II).

The hazards of existing and new beryllium operations, as all operations at LLNL, are assessed in accordance with the five guiding principles of Integrated Safety Management as implemented in *ES&H Manual*, Volume I, Part 2[14]:

1. Define scope of work
2. Analyze hazards
3. Establish controls
4. Perform work
5. Feedback

Beryllium operations posing risk, as defined in Health and Safety Manual Supplement 21.10,[15] are required to be documented in an Operational Safety Plan (OSP) or Facility Safety Plan (FSP). These operations have been reviewed for conformance with LLNL's Integrated Safety Management Program. The process is described in detail in the appropriate sections of the ES&H Manual[16] and Industrial Hygiene Program Policy and Information Manual.[17] The results of these reviews are documented in an Integration Work Sheet (IWS); specific controls, when needed, are documented in FSPs/OSPs, Safety Analysis Documents or Reports (SAD or SAR), or other ES&H documents as needed.

The industrial hygiene hazard assessment process is conducted by the ES&H Field Team industrial hygienists under the policies and procedures established by the Industrial Hygiene Technical Leader[18]. IHPIM #50, noted above in the IHPIM (see also Section V), provides general guidance on hazard assessment. A protocol needs to be developed addressing the following issues as required by the Rule:

-analysis of existing conditions
-exposure data
-medical surveillance trends
-exposure potential of planned activities

Areas where beryllium work is done, or where beryllium use is incidental to other research, is summarized in Appendix C, Current Beryllium Operations. Work related to repair, maintenance, decommissioning, and monitoring of equipment and facilities that

[14] *Environment, Safety, and Health Manual*, UCRL-MA-113867, Volume I, Part 2, "ES&H Management Requirements," specifically "Laboratory and ES&H Policies, General Worker Responsibilities, and Integrated Safety Management"
[15] Health and Safety Manual Supplement 21.10, "Safe Handling of Beryllium and Its Compounds," section entitled "Administrative Controls," December 1991.
[16] *Environment, Safety, and Health Manual*, UCRL-MA-113867, Volume I, Part 2, "ES&H Management Requirements," specifically "Managing ES&H for LLNL Work"
[17] IHPIM #50, "Exposure Assessment and Monitoring Plan"
[18] Hazards Control Manual

are part of or support these operations shall also be considered “Current Beryllium Operations.”

For historical operations, see section II, “Baseline Inventory,” of this document.

Action Required:

(1) Complete an IWS, and Hazard Assessment if required, for all current operations that involve work with beryllium, or may result in beryllium exposure; those operations with the highest exposure potential shall be given priority over operations of lesser exposure potential. Use this information to meet the requirements of sections V through X of this CBDPP.

(2) Develop a protocol for assessing former beryllium work areas identified in the baseline beryllium inventory.

(3) Perform hazard assessments for historical operations to determine residual risk, if any.

IV. Exposure Standards (10 CFR 850.22 and .23)

It is LLNL policy that beryllium hazards will be controlled to assure that no worker is exposed to airborne beryllium in excess of the PEL, 2 µg/m^3, as an 8-hour time weighted average[19]. This is done through implementation of existing LLNL programs (see section III. Hazard Assessments, above).

LLNL adopted 0.2 µg/m^3, as an 8-hour time weighted average, as the action level for beryllium work in the LLNL beryllium control program prior to 10 CFR 850. This standard will continue to apply to LLNL beryllium work.

Specific actions to be taken if exposures exceed the action level or permissible exposure level are enumerated in Health and Safety Manual Supplement 21.10, Table 3. These actions are presently[20]:

Condition	Action
<0.2 µg/m^3	Normal: no action required.
0.2-2.0 µg/m^3	Warning: investigate cause and correct.
>2 µg/m^3	Limit exceeded: stop work and correct

10 CFR 850.23 invokes additional requirements if the action level is exceeded. Implementation of those portions of the Rule are addressed in Sections V-X and XVIII of this CBDPP.

Action Required: None.

The requirements of the Rule to assure that workers are not exposed above the PEL, and to establish an action level are considered complete.

[19] *Health and Safety Manual*, Supplement 21.10, "Safe Handling of Beryllium and It's Compounds"
[20] This action is not consistent with the intent of 10 CFR 850. See Section VI for implementation of the exposure minimization aspects of the Rule.

V. Exposure Monitoring (10 CFR 850.24)

(a) General

Exposure monitoring for chemical exposures is the responsibility of the ES&H Team industrial hygienists under the direction of policies and procedures established by the Industrial Hygiene Technical Leader[21]. Non-routine personal sampling is typically handled by the industrial hygienists; routine personal sampling (periodic monitoring when required) is identified in the Industrial Hygiene Discipline Action Plan (IH DAP Field Instruction #14)[22], and typically is performed by the Health and Safety Technicians.

The current LLNL exposure assessment program is documented in IHPIM #50[23] which provides general guidance in exposure assessment. IHPIM #50 addresses the following topics:

Monitoring methodology (personal air, area air, and surface sampling)
Initial characterization
Qualitative assessment
Quantitative assessment
Data interpretation and reassessment

A variety of references are available for exposure assessment methodologies, such as the AIHA's *A Strategy for Assessing and Managing Occupational Exposure* or DOE's *Occupational Exposure Assessment*. The OSHA expanded health standards also provide guidance for when sampling may be discontinued (see for example 29 CFR 1910.1027). The appropriate methodology for a given workplace situation is determined by the cognizant industrial hygienist.

The present version of the IH DAP does not conform with the sampling frequency required by 10 CFR 850.24.

Action Required:

(1) Revise IH DAP Field Instruction #14 to include initial and periodic sampling requirements of all beryllium work as specified in the Rule.

(b) Initial Monitoring (i.e., personal monitoring conducted after January 7, 2000) has not been done for all beryllium operations and is presently not specified as a requirement in H&S Manual Supplement 21.10.

Action Required:

(1) Perform initial monitoring as required for all beryllium work identified in section III, Hazard Assessments, of this CBDPP.

(2) Revise H&S Manual Supplement 21.10 to specify the requirement for initial monitoring.

[21] Hazards Control Manual
[22] HC Field Support Instruction, "Instruction #14: Beryllium Monitoring," February 1, 1996
[23] IHPIM #50, "Exposure Assessment and Monitoring Plan"

(c) Periodic Monitoring has not been established as a requirement in H&S Manual Supplement 21.10.

Action Required:

(1) Revise IH DAP Field Instruction #14 to include initial and periodic sampling requirements as specified in the Rule.

(2) Revise H&S Manual Supplement 21.10 to specify the requirement for periodic monitoring. Monitoring shall be done as follows:

- personal monitoring shall be performed quarterly when exposure exceed the action level

(d) Additional monitoring has not been established as a requirement in H&S Manual Supplement 21.10. Additional monitoring shall be done as follows:

- additional monitoring shall be conducted if there is a change in operations, maintenance, or procedures, or if there is any reason to suspect such a change has occurred

Action Required:

(1) Revise IH DAP Field Instruction #14 to include additional sampling requirements as specified in the Rule.

(2) Revise H&S Manual Supplement 21.10 to specify the requirement for additional monitoring.

(e) Accuracy of monitoring: The monitoring procedure in use meets the accuracy requirements of the Rule.

Action complete.

(f) Analysis: Personal exposure samples for beryllium are analyzed by the Hazards Control Industrial Hygiene Laboratory. It is accredited by the American Industrial Hygiene Association and participates in the PAT program for metals.

Action complete.

(g) Notification of Monitoring Results: A policy and procedure are in place for notifying workers and the Health Services Department (including the Medical Director) of all personal exposure measurements.[24] The policy does not currently have a provision to notify DOE in event of exposures above the action level or to notify the worker within 10 days of the receipt of monitoring results.

The following topics are included in personal monitoring reports:

[24] IHPIM #52, "Personal Monitoring Reports," version 7/8/96

- Calculated 8-hour time weighted average, excursion, short-term or ceiling exposure level, with a brief discussion of the relevance of this figure.
- Relevant exposure limits.
- Types of personal protective equipment used (respirator, gloves, etc - specify type of each).
- When overexposures are determined, regardless of the use of a respirator, provide recommendations for improving engineering, administrative or personal protective control measures to reduce exposure.
- Training requirements based on results.
- Medical surveillance requirements based on results.
- Need for additional monitoring (if any).
- Reference to appropriate sections of Health and Safety Manual Chapters or Supplements or OSHA standards (Federal and California, as appropriate).
- Statement of supervisor's responsibility for employee notification.
- Sample numbers and/or batch numbers for traceability to sampling and analytical data

Action Required:

(1) Revise IHPIM #52 to specify that (1) the DOE shall be copied on exposure reports where exposures above the action level are measured and (2) the employee shall be notified in writing within 10 days of receipt of monitoring results by the cognizant IH.

VI. Exposure Reduction and Minimization (10 CFR 850.25)

Recent exposure monitoring data, i. e., data taken as a part of on-going monitoring programs and in response to DOE N440.1, indicates that LLNL beryllium exposures are below the action level of 0.2 $\mu g/m^3$. Copies of these reports are maintained in the Hazards Control Department files. A summary of the data is provided in Appendix E.

The Appendix E data is not presented in all cases as meeting the initial monitoring requirements of the Rule, some were taken prior to the January 7, 1999 cut-off. Nonetheless, the data serves to indicate the magnitude of current exposures at LLNL. The data, with the exception of one data point in a series (average of the series is substantially less than the action level), is below the action level of 0.2 $\mu g/m^3$, or for short term exposures, below the ceiling level.

The Rule requires a formal exposure minimization program when exposures exceed the action level. The data indicates this is not the case at LLNL. Therefore a formal exposure reduction and minimization program is not required. Nonetheless, exposure minimization is still required, if practicable.

LLNL policies and programs to control exposures to hazardous materials, including beryllium, are promulgated in the *Environment, Safety, and Health Manual*[25]. Relevant sections on engineering controls, administrative controls, and personal protective equipment are in Volume I (ES&H Management) and Volume II (Health & Safety Controls). Through this manual the applicable Work Smart Standards are implemented.

Health and Safety Manual Supplement 21.10, "Safe Handling of Beryllium and Its Compounds," provides specific guidance on controlling exposure to beryllium regardless if the exposure exceeds or is below the action level. The conventional industrial hygiene controls (engineering, administrative, and personal protective equipment) are specifically addressed. The supplement needs to be revised to specify that the order of controls is to follow the conventional industrial hygiene hierarchy: first engineering control, then administrative control, lastly personal protective equipment when other controls are inadequate or while other controls are being implemented.

Personal exposure data (see Appendix E, "Exposure Data") for approximately the last ten years indicates that typical exposures are well below the action level (indeed below the analytical detection limit).

The specific Laboratory policy for keeping exposures to hazardous materials (including beryllium) as low as reasonably achievable is set forth in the *ES&H Manual*, Volume I, Part 2, "Laboratory and ES&H Policies, General Worker Responsibilities, and Integrated Safety Management," specifically section 1.3.1 of this chapter.

If exposures are measured above the action level, or if a hazard assessment indicates the potential for exposure above the action level, a formal ALARA program will be established to minimize both the number of employees exposed and the potential opportunities for exposure. The program will include the following elements:

- Annual goals for exposure reduction and minimization
- A rationale and strategy for meeting those goals

[25] Environment, Safety, and Health Manual, UCRL-MA-113867

- Actions to be taken to meet those goals
- A means of tracking progress toward those goals or demonstrating that they have been met.

When measurable levels of beryllium are found in personal air samples, but levels are below the action level, the following actions are to be considered:

- Review the operation with the worker or worker(s) involve, and their supervisors.
- Verify that engineering controls are working properly, and determine if improvements are feasible.
- Review work practices to determine if there were changes from accepted practices, or if changes should be effected.
- Arrange to conduct further air sampling to either validate exposures (if no change to controls have been made) or to establish a new baseline for exposures (if changes to controls were made).

In each case, consideration shall be given to the relative magnitude of the exposure. Priority for review and action shall be given to operations that approach the action level; measured exposures that are slightly above the detection level, and well below the action level do not require the same level of attention as higher exposures.

Action Required:

(1) Revise Health & Safety Manual Supplement 21.10 to include the requirement for review of operations where measured beryllium exposures are less than the action level to determine if further reduction is feasible.
(2) Revise Health & Safety Manual Supplement 21.10 to include the conventional hierarchy of industrial hygiene controls (engineering control, administrative control, personal protective equipment).

VII. Regulated Areas (10 CFR 850.26)

At this point in time, no regulated beryllium work areas have been established at LLNL. All current sampling data indicates exposures are less than the action level of 0.2 $\mu g/m^3$. See Section VI and Appendix E for a summary of exposure measurements.

Personal air sampling is conducted as necessary (see Section V. Exposure Monitoring (10 CFR 850.24)) for new operations. If exposures meet, or exceed, the action level, then a regulated area will be established. Regulated areas may be of two types: (i) indoor work areas or (ii) outdoor areas.

When established, both indoor and outdoor regulated areas will be posted with a sign with the following wording at all access points:

DANGER
BERYLLIUM CAN CAUSE LUNG DAMAGE
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

The following information will be recorded when a regulated area is established:

- Name
- Date, and time in, time out
- Work performed

Indoor regulated areas for permanent operations will be maintained at negative pressure with respect to other operational areas unless not feasible. For temporary activities, regulated areas will be established using proven protocols to contain and control contamination. See, for example, Appendix F of the OSHA asbestos in construction standard.[26]

Outdoor regulated areas will be established as needed.

Regulated areas may be temporary or permanent. Temporary regulated areas will exist only when measured exposures meet or exceed the action level, and will be disestablished when exposures are reduced below the action level. Outdoor regulated areas are expected to be temporary and dependent on the specific activity.

Action Required: None.

The requirement of the Rule to establish regulated areas where exposures meet or exceed the action level is considered to be complete.

[26] 29 CFR 1926.1101, "Asbestos"

VIII. Hygiene Facilities and Practices (10 CFR 850.27)

Hygiene facilities (change rooms, showers, and handwashing facilities) are closely linked with regulated areas. At present there are no regulated areas, therefore hygiene facilities are not required. See Section VI and Appendix E for a summary of exposure measurements.

If required, temporary or permanent hygiene facilities will be established using proven protocols for controlling and containing contamination. See reference (16) of Section VII, Regulated Areas, for specifics.

If exposures are measured at or above the action level, the following practices and facilities will be established:

- General
  -food or beverage products shall not be used in the regulated area
  -cosmetics shall not be applied in the regulated area
  -beryllium workers shall not exit regulated areas with contamination on their clothing
- Change Rooms shall be provided for regulated areas
  -separate facilities free of contamination shall be provided for workers to change into and store personal clothing, clean protective clothing and equipment
  -change room shall be maintained at negative pressure or located so as to minimize the spread of contamination
- Showers and handwashing facilities shall be provided for regulated areas and shall be used at the end of the shift
- Lunchroom facilities shall be established for regulated areas
  -readily accessible facilities shall be provided that are free of beryllium and do not result in exposures above the action level
  -workers shall not enter the lunchroom with contamination on their clothing

29 CFR 1910.141, Sanitation, which applies to the facilities required by this section has been adopted as a Work Smart Standard.

Action Required: None.

The requirement of the Rule to establish hygiene facilities is considered complete.

IX. Protective Clothing and Equipment (10 CFR 850.28 and .29)

The LLNL Work Smart Process has adopted 29 CFR 1910 Subpart I, "Personal Protective Equipment," which includes sections 1910.132, "General Requirements" and 1910.134, "Respiratory Protection" as contractually binding[27]. These are presently implemented, in part, by appropriate sections of the *ES&H Manual*, Volume II, Part 2, "Chemical" (H&S Manual Supplement 21.10) and Part 13, "General H&S Controls – Safety Equipment" (H&S Manual Chapter 10: "Personal Protective Equipment"). Specific Respiratory Protection Program implementation is through the following industrial hygiene policy documents[28]:

IHPIM #150 General Policy and Contents
IHPIM #151 Audits and Surveillance
IHPIM #152 Issue and Return
IHPIM #153 Respirator Selection
IHPIM #154 Breathing Air Quality
IHPIM #155 Respirator Training
IHPIM #156 Fit Testing
IHPIM #157 Single Use Dust/Mist

IHPIM #153, "Respirator Selection" addresses voluntary use of respirators for any hazardous material, including beryllium. A respirator will be provided, if requested even if not needed, but all aspects of the respiratory protection program apply (medical qualification, fit testing, training, and hazard assessment).

The general requirements for protective clothing are addresses in H&S Manual Chapter 10, "Personal Protective Equipment," and briefly expanded upon in Supplement 21.10, "Safe Handling of Beryllium and Its Compounds." Supplement 21.10 is being revised to include the following specific requirements:

- PPE is required when airborne Be is measured at or above the action level
- PPE is required when surface contamination levels are above the housekeeping standard
- PPE is required when requested by a beryllium-associated worker
- Procedures are required for donning/doffing, handling, and storing PPE that prevent workers from exiting contaminated areas with beryllium on their clothing or entering contaminated areas without full-body protective clothing
- Prohibition from removing contamination in such a manner that will disperse it into the air
- PPE shall be maintained to ensure its effectiveness
  -if contaminated, shall be handled in such a manner to prevent spread of contamination
  -if contaminated, appropriate information and procedures shall be provided to organizations that launder the PPE to preclude exposure to their employees.

The relevant parts of the *ES&H Manual* are currently under revision and do not presently implement all the requirements of the referenced OSHA rule and the cited sections of 10 CFR 850.

[27] Prime Contract W-7405-ENG-48 ("Contract 48"), Appendix G, "DOE Directives," specifically "Work Smart Standards Set for LLNL," effective November 4, 1999.
[28] IHPIM #150 through #157

Action Required:

(1) Finish revision of ES&H Manual, Volume II, Part 13, Chapter 10: "Personal Protective Equipment." [Approved by LLNL Management 5/30/00.]

(2) Revise H&S Manual Supplement 21.10 to include (i) requirements for respiratory protection when workers are exposed or potentially exposed at or above the action level, or if there is a potential for exposures at or above the action level and (ii) requirements for protective clothing when exposure at or above the action level.

(3) Ensure that Be worker training includes these requirements.

X. Housekeeping (10 CFR 850.30)

The housekeeping standard, 3 µg/100 cm^2 promulgated in 10 CFR 850.30 is consistent with the maximum level established by the LLNL beryllium control program, H&S Manual Supplement 21.10, for designated beryllium work areas. The program implies a housekeeping program, but does not explicitly require one. The Industrial Hygiene Disciple Action Plan, Instruction #14, "Beryllium," addresses periodic surface sampling, but does not address sampling during non-operational periods.

The Rule limits surface contamination levels to 3 µg/100 cm^2 during non-operational periods, but does not define "non-operational period." The preamble to the final rule states that it is not the intent to require sampling during the work shift. LLNL defines the term "non-operational period" to mean that period after which a beryllium operation has concluded; a beryllium operation may last less than one work shift, or may extend over several shifts. During the operation, the work shift will meet the OSHA standard for housekeeping which states[29]:

> 29 CFR 1910.141(3)(i) All places of employment shall be kept clean to the extent that the nature of the work allows.

This will be tempered with the LLNL-established warning level of 1 µg / 100cm^2 for surface contamination levels in beryllium work areas. The surface criteria standards apply to those items and equipment that the handling of which may result in exposure if surface contamination is present. They do not apply to the interiors of chambers, enclosures, ventilation systems, and the like, used to control beryllium exposure.

The existing H&S Manual Supplement 21.10 provides requirements for decontamination consistent with the Rule:

- Decontamination of areas and equipment shall be performed regularly
- Wet methods or HEPA-equipped vacuums only shall be used for cleanup
- Equipment that is potentially contaminated shall be labeled

H&S Manual Supplement 21.10 will be revised to include the following controls:

- Compressed air or dry cleaning shall not be used to clean items where beryllium contamination may be present
- Items used for cleaning beryllium contamination shall not be used for the clean-up of non-hazardous materials.

HEPA-filtered systems shall be maintained and evaluated for collection efficiency as required by existing LLNL policy and procedures.[30] [31]

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[29] 29 CFR 1910.141(3)(i), "Sanitation: housekeeping."

[30] *Environment, Safety, and Health Manual*, UCRL-MA-113867, Volume I, Part 13, "General H&S Controls-Safety Equipment," specifically chapter 12, "Ventilation, Supplement 12.05, "High-Efficiency Particulate Air (HEPA) Filter System Design Guidelines for LLNL Applications

[31] IH Field Instruction #25, "Toxic Material Vacuums"

The IH Discipline Action Plan for facilities in IH Field Instruction #14, "Beryllium" lists those areas that require periodic surface sampling. The frequency of sampling is dependent on the nature and frequency of the work. Frequency varies from weekly to annually, but does not address sampling at the end of "operational periods." The cognizant IH determines the frequency of sampling. The general guidance is that a new or uncharacterized operation will have surface sampling done at a greater frequency. As information about the process is gathered, the sampling frequency may change to longer or shorter intervals. Sampling locations are also determined by the cognizant IH, in consultation with the Health and Safety Technician for the area. Consideration is given to the nature of the process, how the worker handles the parts and equipment used to work the part, and the flow of material through the shop or laboratory. Consideration is also given to handling items that are not part of the process (for example, telephone, door handles, floors, etc.) that would indicate lack of control if contamination were found.

Actions Required:

(1) Revise H&S Manual Supplement 21.10 to include requirement for housekeeping and surface contamination surveys; define "non-operational period."

(2) Revise Field IH DAP Instruction #14 to require surface sampling at the conclusion of work, i. e., during non-operational periods. Provide additional guidance on sampling frequency.

(3) Ensure that Be training includes housekeeping requirements.

XI. Release Criteria (10 CFR 850.31)

Policy and procedure for release of equipment is established in *ES&H Manual*, Volume II, Part 3, "ES&H Requirements for Equipment Repair, Transfer, Storage, and Excess," formerly Health & Safety Manual Supplement 8.07.[32] This supplement addresses general requirements applicable to all hazardous materials.

The Rule establishes two release criteria: one of 3 µg/100 cm^2 and one of 0.2 µg/100 cm^2 which also requires items to be labeled with a beryllium contamination warning, even if cleaned. The Rule also establishes the policy that items shall be cleaned to the lowest level practicable, but not in excess of these criteria. This is a change from former LLNL practice and thus is not reflected in H&S Manual Supplement 21.10.

The 3 µg/100 cm^2 level is required for release of material to another facility performing work with beryllium. For the purposes of this Rule, LLNL considers the term "facility" to mean collectively all locations where beryllium work is done at LLNL, i. e., all LLNL beryllium work areas constitute one facility. Therefore, for parts being transferred from one shop or laboratory to another within a building, or to a different building for further work this limit does not apply. The 3 µg/100 cm^2 release criteria applies when equipment or other items are released to a beryllium work area in another DOE facility.

The 0.2 µg/100 cm^2 level applies to release of potentially contaminated equipment to the public, non-beryllium work areas of other DOE facilities, or non-beryllium work areas of LLNL. Non-beryllium work areas at LLNL are specially excluded from the "one facility" interpretation noted in the preceding paragraph.

Release of items to non-beryllium work areas or non-DOE facilities is contingent upon the recipient's commitment to implement controls that will prevent foreseeable beryllium exposure. This is not presently reflected in H&S Manual Supplement 21.10.

Labeling is required for all items, regardless of destination. Appropriate packaging is required to prevent potential exposure to beryllium dust. Existing LLNL policy presently requires both labeling of contaminated items or containers of beryllium containing materials and proper packaging. The wording on existing labels does not use the required language. See Section XVIII, "Warning Signs and Labels," for specific wording requirements.

Action Required:

(1) Revise H&S Manual Supplement 21.10 to implement release criteria and labeling requirements.

(2) Ensure that Be worker training includes release criteria and labeling requirements.

[32] *Environment, Safety, and Health Manual*, UCRL-MA-113867, Volume II, Part 3, "ES&H Requirements for Equipment Repair, Transfer, Storage, and Excess,"

XII. Waste Disposal (10 CFR 850.32)

The Rule does not establish new requirements, other than labeling addressed in §850.38, for the handling of beryllium or beryllium-contaminated waste. The requirements for disposal of all hazardous waste are implemented by *ES&H Manual*, Volume III, "Environmental Hazards and Controls" (formerly *Environmental Compliance Manual)*,[33] and *Waste Acceptance Criteria (WAC).*[34] The following identifies the types of waste at LLNL that may contain beryllium and notes the applicability of 10 CFR 850:

Description	Typical Waste Stream	Applicability of 10 CFR 850
Aqueous waste with low other toxic organics	Low-level radioactive coolant wash waters with low concentrations of organic compounds, metals and/or other toxic materials generated from operations such as machining. Wash waters may contain beryllium.	Not applicable unless solid residue is present (>0.1% Be)
Spent acid with metals	Low-level radioactive acidic solutions and rinse waters with metals generated from research activities including electroplating and metal finishing operations. Wastes may include plating baths, chromic acid mixtures and nitric acid solutions from bright dip tanks, with at least one or more of the following metals: chromium, copper, aluminum, nickel, zinc, cadmium, lead, or beryllium.	Not applicable unless solid residue is present (>0.1% Be)
Waste oil	Low-level radioactive waste oils generated from laboratory research and machine shop operations. Wastes may include hydraulic and vacuum pump oils, uranium, beryllium, mercury and/or solvents.	Not applicable unless solid residue is present (>0.1% Be)
Metal scale, filings, or scrap	Low-level radioactive lead pieces and bricks contaminated with depleted uranium and/or beryllium during off-site explosion and/or projectile research activities.	Applicable
Spent solid filters or adsorbants	Spent HEPA filters and absorbents generated by research activities and facility maintenance. Wastes may contain low-level radioactivity, solvents, lead, beryllium, and/or cadmium.	Applicable
Other waste inorganic solids	Low-level radioactive inorganic trash generated by research and laboratory cleanup activities. Wastes may include pipettes, funnels, beakers, gloves, paper, filters, plastics, sponges, floor dry, and other lab trash. Wastes may be contaminated with	Applicable unless Be is soluble

[33] *Environment, Safety, and Health Manual*, UCRL-MA-113867, Volume III, "Environmental Hazards and Controls."

[34] Environmental Protection Department, *Waste Acceptance Criteria*, UCRL-MA-115877 Rev. 1, August 1997.

	beryllium, lead, and/or low-level radioactive materials.	

Specific waste handling requirements and guidelines are outlined in *ES&H Manual*, Volume 3, Chapter 9, "Waste Management Requirements." The specific labeling requirements of the Rule are not in place.

The Laboratory's policy for waste minimization applies to all hazardous materials, not just beryllium. The Laboratory's ES&H policies, including waste minimization are available at http://www.llnl.gov/es_and_h/policies.html. These are implemented through the *ES&H Manual*. The waste minimization program is detailed in *ES&H Manual*, Volume III, Part 7, "Waste Minimization and Pollution Prevention."

Action Required:

(1) Modify Chapter 9, "Waste Management Requirements" and the *WAC* to include the labeling requirements of 10 CFR 850.32.

XIII. Emergencies (10 CFR 850.33)

LLNL has adopted 29 CFR 1910.120 in its entirety as a Work Smart Standard. The specific sections adopted by the Rule are 1910.120(l), “Emergency response by employees at uncontrolled hazardous waste sites,” and 1910.120(q), “Emergency response to hazardous substance releases.” These sections are implemented by the LLNL Emergency Management Program through the *ES&H Manual*, Volume II, “Health & Safety Hazards and Controls” and Volume III, “Environment Hazards and Controls.” The LLNL Emergency Management Program implements DOE Order 151.1, “Comprehensive Emergency Management System,” which incorporates requirements of 29 CFR 1910.120.

LLNL has no uncontrolled hazardous waste sites so that portion of 29 CFR 1910.120 is not applicable.

Action Required: None.

The requirement of the Rule to implement 29 CFR 1910.120(l) and (q) is considered complete.

XIV. Medical Surveillance (10 CFR 850.34)

Medical services (in part: medical surveillance, medical approvals for respirator use, emergency medical care and treatment, laboratory tests and clinical procedures) are provided by the Health Services Department, which is a department of LLNL under the Deputy Director for Operations. It is headed by the LLNL Medical Director and is staffed by licensed health care professionals.

Due to the complexity and number of requirements of the Rule for medical surveillance, medical consent, medical removal protection, and counseling, as well as the medical specific record keeping and feedback aspects, these specific requirements of the Rule are addressed comprehensively in Appendix F. General actions are addressed below.

A beryllium medical surveillance program is already in place which emphasizes voluntary LPT testing based on past or present exposure potential. The current program will need to be augmented to incorporate the requirements of the rule:

The scope of the medical surveillance program will need to be expanded in terms of clinical services provided to the covered population.

The medical consent form in current use differs from the mandatory form required by Appendix A of the Rule.

OSHA reporting of adverse health effects from beryllium exposure currently follows OSHA requirements[35, 36] and not the requirements of the Rule.

Data analysis (medical, job, and exposure data) is addressed in Section XX. Performance Feedback of this CBDPP.

Actions Required:

(1) Revise the methodology for reviewing the population at risk and begin to re-categorize them as Beryllium Workers, Beryllium Associated Workers, or not exposed.

(2) Update the beryllium medical surveillance program to include all requirements of the Rule (scope including baseline and periodic evaluations, multiple physician review, process for identification of population at risk, medical consent.)

(3) Include the mandated consent form as part of the medical surveillance program.

(4) Revise the current protocol for recording occupational injury and illness to include the requirements of 10 CFR 850.34(g).

[35] 29 CFR 1904, "Recording and Reporting Occupational Injury and Illness"
[36] US Department of Labor, "Recordkeeping Guidelines for Occupational Injuries and Illnesses," September 1986.

(5) Ensure that data on sensitization and CBD rates are regularly analyzed and the results issued to identify needs for exposure controls or new surveillance needs.

XV. Medical Removal (10 CFR 850.35)

LLNL established an Interim Medical Protection Guideline for current and prospective employees.[37] This policy is consistent with the intent of the Rule, but does not include the scope of activities required by it. The policy needs to be revised to:

1. Require written documentation of the medical opinion recommending medical removal.

2. Change the perspective of the policy to the employer being proactive in offering medical removal when warranted, rather than reacting to an employee's request upon being notified of sensitization or disease.

3. Include the specific requirements of the Rule for temporary and permanent medical removal where they differ from the Interim Guideline.

4. Include the specific requirements of the Rule for medical removal protection benefits where they differ from the Interim Guideline.

Due to the complexity and number of requirements of the Rule for medical surveillance, medical consent, medical removal protection, and counseling, as well as the medical specific record keeping and feedback aspects, these specific requirements of the Rule are addressed comprehensively in Appendix F.

Actions Required:

(1) Revise Appendix A (Interim Medical Protection Policy) of H&S Manual Supplement 21.10 to include the specific requirements of the Rule.

(2) Revise OH-4250 to include the workers' rights and employers' responsibilities under the medical removal program.

[37] H&S Manual Supplement 21.10, Appendix A, "Interim Medical Protection Guidelines for Current and Prospective Beryllium Workers."

XVI. Medical Consent (10 CR 850.36)

The issue of the medical consent form is addressed under XIV. Medical Surveillance.

XVII.Training and Counseling (10 CR 850.37)

Training

The following training classes are established:

HS4256 Beryllium Worker

This training class is required for all beryllium workers and beryllium associated workers. Initial training is required at the time of initial assignment (or within 90 days). Refresher training is satisfied by HS4256-R. This course shall include the following topics:

- Communication of hazards, controls, signs and symptoms of exposure, and program requirements as required by 29 CFR 1910.1200, “Hazard Communication”
- Contents of the LLNL CBDPP
- Potential health risks to a beryllium worker’s family members due to contact with beryllium on the worker, worker’s clothing, or personal items

HS4256-R Beryllium Worker Refresher

This refresher training is required every two years (after the completion of HS4256) for all beryllium workers and beryllium associated workers, or sooner if there is reason to believe a worker lacks proficiency, sufficient knowledge, or understanding to work safely with beryllium. Retraining is required if there are new hazards or controls about which the worker has not been trained.

HS4258 Beryllium Awareness

This awareness level course is required for all persons working at LLNL, and must be completed within 90 days of beginning work at LLNL. This course must be repeated every two years. This course shall include:

- General awareness about beryllium hazards
- General awareness about beryllium controls

OH4250 Beryllium Medical Issues

This course is presently a requirement for workers previously identified as being in Priority 1 or 2 categories established in the LLNL implementation of DOE N440.1. This course complements HS4256.

Documentation of training is kept by LTRAIN.

Counseling

Presently counseling is done as needed by the Health Services, Hazards Control, Human Resources, and other Departments on a case by case basis. The program needs to be formalized. General actions are identified below; specific items are discussed in more detail in Appendix F.

Actions Required:

(1) Finalize instructional design of HS4256, Beryllium Worker.

(2) Complete instructional design of HS4256-R, Beryllium Worker-Refresher.

(3) Complete instructional design of HS4258, Beryllium Awareness.

(4) Revise LTRAIN questions to identify appropriate training for beryllium workers and beryllium associated workers.

(5) Formalize the counseling program and appraise workers of its availability though the beryllium worker training program, HS4256 and OH4250.

(6) Formalize the counseling program and develop written materials for affected employees that include all subjects required by 10 CFR 850.37(f).

XVIII. Warning Signs and Labels (10 CFR 850.38)

Warning signs are presently required by H&S Manual Supplement 21.10 for beryllium work areas and shipping/storage containers of beryllium where exposure is likely, but do not include (1) the language required by the Rule and (2) the specific posting requirements of the Rule.

The following sign is used to post beryllium work areas; it will be retained for areas that are not regulated areas as defined by the Rule:

DANGER
Beryllium Dust (or Fume)
Areas

Unauthorized Persons
KEEP OUT

Inhalation of Dust or Fume May Cause
Serious Chronic Lung Disease

Potential Cancer Hazard

The posting requirements for regulated areas has been previously discussed, see Section VII for details.

H&S Manual Supplement 21.10 presently requires labels for containers of beryllium or its compounds where exposure is possible; the labeling requirement will be changed to the following:

DANGER

Contaminated with Beryllium
Do Not Remove Dust by Blowing or Shaking

Cancer and Lung Disease Hazard

Other labeling shall be as required by 29 CFR 1910.1200, “Hazard Communication,” an LLNL-adopted WSS standard.

Action Required:

(1) Revise H&S Manual Supplement 21.10 for posting of regulated areas and warning signs for containers of beryllium, beryllium compounds, beryllium-contaminated clothing, equipment, waste, scrap, or debris.

XIX. Recordkeeping (10 CFR 850.39)

Records Retention

The following records are maintained pursuant to 10 CFR850:

1. Baseline Beryllium Inventory
2. Hazard Assessments
3. Exposure Measurements (air sample and surface sample results)
4. Personal Exposure Reports
5. Medical Surveillance Records

Items 1-4 are maintained by the Hazards Control Department. Item 5 is maintained by the Health Services Department.

Records retention is determined by DOE[38] and LLNL policies. Relevant documents are the LLNL Records Management Policy Guide, LLNL Records Retention Schedule, and Schedule 10 (Environmental Safety and Health)[39]. Medical records access and retention are addressed in the Health Services Medical Records Policy.[40] The records retention schedule identifies a specific retention frequency (for example, 75 years for industrial hygiene records); however all health related records are covered by the DOE Epidemiological Moratorium which prohibits destruction.

In the event LLNL is no longer involved in beryllium work covered under this CBDPP, all records required by the CBDPP shall be conveyed to DOE.

Use of Information

Records generated by the CBDPP (for example: exposure measurements, contamination assessment, hazard assessments, workplace conditions, medical surveillance results, and health outcomes) will be used as required for performance feedback (see Section XX, following) to aid in understanding the beryllium exposure health risk, and when appropriate, measuring progress toward exposure reduction and minimization goals. This information will be maintained in a database that links workplace conditions (including exposure measurements and hazard assessments) and health outcomes (including medical surveillance results).

Beryllium Registry

Information in the records identified above will contain the necessary information for the DOE Office of Epidemiology Beryllium Registry. At this time guidance is not available for the full scope of data elements required, format, and software. Data transmission to the Beryllium Registry is required semi-annually.

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[38] DOE Epidemiological Moratorium implemented via LLNL Administrative Memo (Policy and Procedure), Vol. 22, No. 10, April 29, 1992.

[39] Official versions of the relevant documents are maintained on the Archives and Records Management Group web-page at https://www-ais.llnl.gov/llnl_only/docs/bsd/records/records.html

[40] Access to HSD Medical Records – Policy Statement, December 17, 1998.

The requirements of the Rule to protect workers' confidentiality shall be implemented with the Beryllium Registry.

Action Required:

(1) A database with the required Beryllium Registry information will be developed utilizing guidance from the DOE[41].

(2) The database will link health outcomes and workplace conditions.

[41] Draft guidance presently exists in a 5/17/00 document, "Beryllium-exposed Worker Registry Data Collection and Management Guidance," from DOE/EH, Office of Epidemiology. This document describes the Beryllium Registry as a set of three linked data sets: (1) Roster of Beryllium-exposed Workers; (2)DOE Beryllium Activities and Exposure Surveillance Data Set, and (3) Beryllium-related Medical Surveillance Data Set. The data is linked through the unique identifier and site code which are common to all three data sets.

XX. Performance Feedback (10 CFR 850.40)

The LLNL implementation of ISM, previously referred to in the *ES&H Manual*, Volume I, includes as one of the five functions: Provide feedback for continuous improvement. Part 5, "Feedback and Improvement" establishes the requirement for each Directorate to conduct ES&H self-assessments. While not specifically called out, the beryllium control program is covered by this program.

Performance feedback shall include, as a minimum, the following topics:

- Personal air sample results.
- Surface contamination samples.
- Correlation of adverse health effects (medical surveillance: sensitization or disease) with exposure measurements.
- Evaluation of engineering controls such as ventilation system performance or HEPA filter test results.
- Exposure reduction and minimization.
- Tracking of completion of beryllium control program deficiencies.
- Mechanism for providing feedback to persons working with beryllium.
- Consideration of findings for the LLNL lessons learned program.

Action Required:

(1) Develop a joint program review plan with the Directorates, Health Services Department, and Hazards Control Department to provide a periodic assessment of the effectiveness of beryllium controls and to relate health outcomes to exposure.

Appendix A. 10 CFR 850—Chronic Beryllium Disease Prevention Program

Authority: 42 U. S. C. 2201(i)(3), (p); 29 U. S. C. 668; E.O. 12196, 3 CFR 1981 comp., p. 145 as amended.

Subpart A—General Provisions

§ 850.1 Scope. This part establishes a chronic beryllium disease prevention program (CBDPP) that supplements and is integrated into existing worker protection programs that are established for Department of Energy (DOE) employees and DOE contractor employees.

§ 850.2 Applicability.

(a) This part applies to:

(1) DOE offices responsible for operations or activities that involve present or past exposure, or the potential for exposure, to beryllium at DOE facilities;

(2) DOE contractors with operations or activities that involve present or past exposure, or the potential for exposure, to beryllium at DOE facilities; and

(3) Any current DOE employee, DOE contractor employee, or other worker at a DOE facility who is or was exposed or potentially exposed to beryllium at a DOE facility.

(b) This part does not apply to:

(1) Beryllium articles; and

(2) DOE laboratory operations that meet the definition of laboratory use of hazardous chemicals in 29 CFR 1910.1450, Occupational Exposure to Hazardous Chemical in Laboratories.

§ 850.3 Definitions.

(a) As used in this part:

Action level means the level of airborne concentration of beryllium established pursuant to section 850.23 of this part that, if met or exceeded, requires the implementation of worker protection provisions specified in that section.

Authorized person means any person required by work duties to be in a regulated area.

Beryllium means elemental beryllium and any insoluble beryllium compound or alloy containing 0.1 percent beryllium or greater that may be released as an airborne particulate.

Beryllium activity means an activity taken for, or by, DOE at a DOE facility that can expose workers to airborne beryllium, including but not limited to design, construction, operation, maintenance, or decommissioning, and which may involve one DOE facility or operation or a combination of facilities and operations.

Beryllium article means a manufactured item that is formed to a specific shape or design during manufacture, that has end-use functions that depend in whole or in part on its shape or design during end use, and that does not release beryllium or otherwise result in exposure to airborne concentrations of beryllium under normal conditions of use.

Beryllium-associated worker means a current worker who is or was exposed or potentially exposed to airborne concentrations of beryllium at a DOE facility, including:

(1) A beryllium worker;

(2) A current worker whose work history shows that the worker may have been exposed to airborne concentrations of beryllium at a DOE facility;

(3) A current worker who exhibits signs or symptoms of beryllium exposure; and

(4) A current worker who is receiving medical removal protection benefits.

Beryllium emergency means any occurrence such as, but not limited to, equipment failure, container rupture, or failure of control equipment or operations that results in an unexpected and significant release of beryllium at a DOE facility.

Beryllium-induced lymphocyte proliferation test (Be-LPT) is an in vitro measure of the beryllium antigen-specific, cell-mediated immune response.

Beryllium worker means a current worker who is regularly employed in a DOE beryllium activity.

Breathing zone is defined as a hemisphere forward of the shoulders, centered on the mouth and nose, with a radius of 6 to 9 inches.

DOE means the U.S. Department of Energy.

DOE contractor means any entity under contract with DOE (or its subcontractor) that has responsibility for performing beryllium activities at DOE facilities.

DOE facility means any facility operated by or for DOE.

Head of DOE Field Element means an individual who is the manager or head of the DOE operations office or field office, or any official to whom the Head of DOE Field Element delegates his or her functions under this part.

High-efficiency particulate air (HEPA) filter means a filter capable of trapping and retaining at least 99.97 percent of 0.3 micrometer monodispersed particles.

Immune response refers to the series of cellular events by which the immune system reacts to challenge by an antigen.

Medical removal protection benefits means the employment rights established by section 850.35 of this part for beryllium-associated workers who voluntarily accept temporary or permanent medical removal from beryllium areas following a recommendation by the Site Occupational Medicine Director.

Operational area means an area where workers are routinely in the presence of beryllium as part of their work activity.

Regulated area means an area demarcated by the responsible employer in which the airborne concentration of beryllium exceeds, or can reasonably be expected to exceed, the action level.

Removable contamination means beryllium contamination that can be removed from surfaces by nondestructive means, such as casual contact, wiping, brushing or washing.

Responsible employer means:

(1) For DOE contractor employees, the DOE contractor office that is directly responsible for the safety and health of DOE contractor employees while performing a beryllium activity or other activity at a DOE facility; or

(2) For DOE employees, the DOE office that is directly responsible for the safety and health of DOE Federal employees while performing a beryllium activity or other activity at a DOE facility; and

(3) Any person acting directly or indirectly for such office with respect to terms and conditions of employment of beryllium-associated workers.

Site Occupational Medical Director (SOMD) means the physician responsible for the overall direction and operation of the site occupational medicine program.

Unique identifier means the part of a paired set of labels, used in records that contain confidential information, that does not identify individuals except by using the matching label.

Worker means a person who performs work for or on behalf of DOE, including a DOE employee, an independent contractor, a DOE contractor or subcontractor employee, or any other person who performs work at a DOE facility.

Worker exposure means the exposure of a worker to airborne beryllium that would occur if the worker were not using respiratory protective equipment.

(b) Terms undefined in this part that are defined in the Atomic Energy Act of 1954 ***shall*** have the same meaning as under that Act.

§ 850.4 Enforcement. DOE may take appropriate steps under its contracts with DOE contractors to ensure compliance with this part. These steps include, but are not limited to, contract termination or reduction in fee.

§ 850.5 Dispute resolution.

(a) Subject to paragraphs (b) and (c) of this section, any worker who is adversely affected by an action taken, or failure to act, under this part may petition the Office of Hearings and Appeals for relief in accordance with 10 CFR part 1003, Subpart G.

(b) The Office of Hearings and Appeals may not accept a petition from a worker unless the worker requested the responsible employer to correct the violation, and the responsible employer refused or failed to take corrective action within a reasonable time.

(c) If the dispute relates to a term or condition of employment that is covered by a grievance-arbitration provision in a collective bargaining agreement, the worker ***must*** exhaust all applicable grievance-arbitration procedures before filing a petition for relief with the Office of Hearings and Appeals. A worker is deemed to have exhausted all applicable grievance-arbitration procedures if 150 days have passed since the filing of a grievance and a final decision on it has not been issued.

Subpart B—Administrative Requirements

§ 850.10 Development and approval of the CBDPP.

(a) Preparation and submission of initial CBDPP to DOE.

(1) The responsible employer at a DOE facility ***must*** ensure that a CBDPP is prepared for the facility and submitted to the appropriate Head of DOE Field Element before beginning beryllium activities, but no later than April 6, 2000 of this part.

(2) If the CBDPP has separate sections addressing the activities of multiple contractors at the facility, the Head of DOE Field Element will designate a single DOE contractor to review and approve the sections prepared by other contractors, so that a single consolidated CBDPP for the facility is submitted to the Head of DOE Field Element for review and approval.

(b) DOE review and approval. The appropriate Head of DOE Field Element ***must*** review and approve the CBDPP.

(1) The initial CBDPP and any updates are deemed approved 90 days after submission if they are not specifically approved or rejected by DOE earlier.

(2) The responsible employer ***must*** furnish a copy of the approved CBDPP, upon request, to the DOE Assistant Secretary for Environment, Safety and Health or designee, DOE program offices, and affected workers or their designated representatives.

(c) Update. The responsible employer ***must*** submit an update of the CBDPP to the appropriate Head of DOE Field Element for review and approval whenever a significant change or significant addition to the CBDPP is made or a change in contractors occurs. The Head of DOE Field Element ***must*** review the CBDPP at least annually and, if necessary, require the responsible employer to update the CBDPP.

(d) Labor Organizations. If a responsible employer employs or supervises beryllium-associated workers who are represented for collective bargaining by a labor organization, the responsible employer ***must***:

(1) Give the labor organization timely notice of the development and implementation of the CBDPP and any updates thereto; and

(2) Upon timely request, bargain concerning implementation of this part, consistent with the Federal labor laws.

§ 850.11 General CBDPP requirements.

(a) The CBDPP ***must*** specify the existing and planned operational tasks that are within the scope of the CBDPP. The CBDPP ***must*** augment and, to the extent feasible, be integrated into the existing worker protection programs that cover activities at the facility.

(b) The detail, scope, and content of the CBDPP ***must*** be commensurate with the hazard of the activities performed, but in all cases the CBDPP ***must***:

(1) Include formal plans and measures for maintaining exposures to beryllium at or below the permissible exposure level prescribed in §850.22;

(2) Satisfy each requirement in subpart C of this part;

(3) Contain provisions for:

(i) Minimizing the number of workers exposed and potentially exposed to beryllium;

(ii) Minimizing the number of opportunities for workers to be exposed to beryllium;

(iii) Minimizing the disability and lost work time of workers due to chronic beryllium disease,

beryllium sensitization and associated medical care; and

(iv) Setting specific exposure reduction and minimization goals that are appropriate for the beryllium activities covered by the CBDPP to further reduce exposure below the permissible exposure limit prescribed in §850.22.

§ 850.12 Implementation.

(a) The responsible employer ***must*** manage and control beryllium exposures in all DOE beryllium activities consistent with the approved CBDPP.

(b) No person employed by DOE or a DOE contractor may take or cause any action inconsistent with the requirements of:

(1) This part,

(2) An approved CBDPP, and

(3) Any other Federal statute or regulation concerning the exposure of workers to beryllium at DOE facilities.

(c) No task involving potential exposure to airborne beryllium that is outside the scope of the existing CBDPP may be initiated until an update of the CBDPP is approved by the Head of DOE Field Element, except in an unexpected situation and, then, only upon approval of the Head of DOE Field Element.

(d) Nothing in this part precludes a responsible employer from taking any additional protective action that it determines to be necessary to protect the health and safety of workers.

(e) Nothing in this part affects the responsibilities of DOE officials under the Federal Employee Occupational Safety and Health Program (29 CFR part 1960) and related DOE directives.

§ 850.13 Compliance.

(a) The responsible employer ***must*** conduct activities in compliance with its CBDPP.

(b) The responsible employer ***must*** achieve compliance with all elements of its CBDPP no later than January 7, 2002.

(c) With respect to a particular beryllium activity, the contractor in charge of the activity is responsible for complying with this part. If no contractor is responsible for a beryllium activity, DOE ***must*** ensure implementation of, and compliance with, this part.

Subpart C—Specific Program Requirements

§ 850.20 Baseline beryllium inventory.

(a) The responsible employer ***must*** develop a baseline inventory of the locations of beryllium operations and other locations of potential beryllium contamination, and identify the workers exposed or potentially exposed to beryllium at those locations.

(b) In conducting the baseline inventory, the responsible employer ***must***:

(1) Review current and historical records;

(2) Interview workers;

(3) Document the characteristics and locations of beryllium at the facility; and

(4) Conduct air, surface, and bulk sampling.

(c) The responsible employer ***must*** ensure that:

(1) The baseline beryllium inventory is managed by a qualified individual (e.g., a certified industrial hygienist); and

(2) The individuals assigned to this task have sufficient knowledge and experience to perform such activities properly.

§ 850.21 Hazard assessment.

(a) If the baseline inventory establishes the presence of beryllium, the responsible employer ***must*** conduct a beryllium hazard assessment that includes an analysis of existing conditions, exposure data, medical surveillance trends, and the exposure potential of planned activities. The exposure determinants, characteristics and exposure potential of activities ***must*** be prioritized so that the activities with the greatest risks of exposure are evaluated first.

(b) The responsible employer ***must*** ensure that:

(1) The hazard assessment is managed by a qualified individual (e.g., a certified industrial hygienist); and

(2) The individuals assigned to this task have sufficient knowledge and experience to perform such activities properly.

§ 850.22 Permissible exposure limit. The responsible employer must assure that no worker is exposed to an airborne concentration of beryllium greater than the permissible exposure limit established in 29 CFR 1910.1000, as measured in the worker's breathing zone by personal monitoring, or a more stringent TWA PEL that may be

promulgated by the Occupational Safety and Health Administration as a health standard.

§ 850.23 Action level.

(a) The responsible employer ***must*** include in its CBDPP an action level that is no greater than 0.2 $\mu g/m^3$, calculated as an 8-hour TWA exposure, as measured in the worker's breathing zone by personal monitoring.

(b) If an airborne concentration of beryllium is at or above the action level, the responsible employer ***must*** implement §§850.24(c) (periodic monitoring), 850.25 (exposure reduction and minimization), 850.26 (regulated areas), 850.27 (hygiene facilities and practices), 850.28 (respiratory protection), 850.29 (protective clothing and equipment), and 850.38 (warning signs) of this part.

§ 850.24 Exposure monitoring.

(a) General. The responsible employer ***must*** ensure that:

(1) Exposure monitoring is managed by a qualified individual (e.g., a certified industrial hygienist); and

(2) The individuals assigned to this task have sufficient industrial hygiene knowledge and experience to perform such activities properly.

(b) Initial monitoring. The responsible employer ***must*** perform initial monitoring in areas that may have airborne beryllium, as shown by the baseline inventory and hazard assessment. The responsible employer ***must*** apply statistically-based monitoring strategies to obtain a sufficient number of sample results to adequately characterize exposures, before reducing or terminating monitoring.

(1) The responsible employer ***must*** determine workers' 8-hour TWA exposure levels by conducting personal breathing zone sampling.

(2) Exposure monitoring results obtained within the 12 months preceding the effective date of this part may be used to satisfy this requirement if the measurements were made as provided in paragraph (b)(1) of this section.

(c) Periodic exposure monitoring. The responsible employer ***must*** conduct periodic monitoring of workers who work in areas where airborne concentrations of beryllium are at or above the action level. The monitoring ***must*** be conducted in a manner and at a frequency necessary to represent workers' exposure, as specified in the CBDPP. This periodic exposure monitoring ***must*** be performed at least every 3 months (quarterly).

(d) Additional exposure monitoring. The responsible employer ***must*** perform additional monitoring if operations, maintenance or procedures change, or when the responsible employer has any reason to suspect such a change has occurred.

(e) Accuracy of monitoring. The responsible employer ***must*** use a method of monitoring and analysis that has an accuracy of not less than plus or minus 25 percent, with a confidence level of 95 percent, for airborne concentrations of beryllium at the action level.

(f) Analysis. The responsible employer ***must*** have all samples collected to satisfy the monitoring requirements of this part analyzed in a laboratory accredited for metals by the American Industrial Hygiene Association (AIHA) or a laboratory that demonstrates quality assurance for metals analysis that is equivalent to AIHA accreditation.

(g) Notification of monitoring results.

(1) The responsible employer ***must***, within 10 working days after receipt of any monitoring results, notify the affected workers of monitoring results in writing. This notification of monitoring results ***must*** be:

(i) Made personally to the affected worker; or

(ii) Posted in location(s) that is readily accessible to the affected worker, but in a manner that does not identify the individual to other workers.

(2) If the monitoring results indicate that a worker's exposure is at or above the action level, the responsible employer ***must*** include in the notice:

(i) A statement that the action level has been met or exceeded; and

(ii) A description of the corrective action being taken by the responsible employer to reduce the worker's exposure to below the action level, if practicable.

(3) If the monitoring results indicate that worker exposure is at or above the action level, the responsible employer ***must*** also notify DOE and the SOMD of these results within 10 working days after receipt.

§ 850.25 Exposure reduction and minimization.

(a) The responsible employer ***must*** ensure that no worker is exposed above the exposure limit prescribed in §850.22.

(b) The responsible employer ***must***, in addition:

(1) Where exposure levels are at or above the action level, establish a formal exposure reduction and minimization program to reduce exposure levels to below the action level, if practicable. This program ***must*** be described in the responsible employer's CBDPP and ***must*** include:

(i) Annual goals for exposure reduction and minimization;

(ii) A rationale for and a strategy for meeting the goals;

(iii) Actions that will be taken to achieve the goals; and

(iv) A means of tracking progress towards meeting the goals or demonstrating that the goals have been met.

(2) Where exposure levels are below the action level, implement actions for reducing and minimizing exposures, if practicable. The responsible employer ***must*** include in the CBDPP a description of the steps to be taken for exposure reduction and minimization and a rationale for those steps.

(c) The responsible employer ***must*** implement exposure reduction and minimization actions using the conventional hierarchy of industrial hygiene controls (i.e., engineering controls, administrative controls, and personal protective equipment in that order).

§ 850.26 Regulated areas.

(a) If airborne concentrations of beryllium in areas in DOE facilities are measured at or above the action level, the responsible employer ***must*** establish regulated areas for those areas.

(b) The responsible employer ***must*** demarcate regulated areas from the rest of the workplace in a manner that adequately alerts workers to the boundaries of such areas.

(c) The responsible employer ***must*** limit access to regulated areas to authorized persons.

(d) The responsible employer ***must*** keep records of all individuals who enter regulated areas. These records ***must*** include the name, date, time in and time out, and work activity.

§ 850.27 Hygiene facilities and practices.

(a) General. The responsible employer ***must*** assure that in areas where workers are exposed to beryllium at or above the action level, without regard to the use of respirators:

(1) Food or beverage and tobacco products are not used;

(2) Cosmetics are not applied, except in change rooms or areas and shower facilities required under paragraphs (b) and (c) of this section; and

(3) Beryllium workers are prevented from exiting areas that contain beryllium with contamination on their bodies or their personal clothing.

(b) Change rooms or areas. The responsible employer ***must*** provide clean change rooms or areas for beryllium workers who work in regulated areas.

(1) Separate facilities free of beryllium ***must*** be provided for beryllium workers to change into, and store, personal clothing, and clean protective clothing and equipment to prevent cross-contamination;

(2) The change rooms or areas that are used to remove beryllium-contaminated clothing and protective equipment ***must*** be maintained under negative pressure or located so as to minimize dispersion of beryllium into clean areas; and

(c) Showers and handwashing facilities.

(1) The responsible employer ***must*** provide handwashing and shower facilities for beryllium workers who work in regulated areas.

(2) The responsible employer ***must*** assure that beryllium workers who work in regulated areas shower at the end of the work shift.

(d) Lunchroom facilities.

(1) The responsible employer ***must*** provide lunchroom facilities that are readily accessible to beryllium workers, and ensure that tables for eating are free of beryllium, and that no worker in a lunchroom facility is exposed at any time to beryllium at or above the action level.

(2) The responsible employer ***must*** assure that beryllium workers do not enter lunchroom facilities with protective work clothing or equipment unless the surface beryllium has been removed from clothing and equipment by HEPA vacuuming or other method that removes beryllium without dispersing it.

(e) The change rooms or areas, shower and handwashing facilities, and lunchroom facilities ***must*** comply with 29 CFR 1910.141, Sanitation.

§ 850.28 Respiratory protection.

(a) The responsible employer ***must*** establish a respiratory protection program that complies with the respiratory

protection program requirements of 29 CFR 1910.134, Respiratory Protection.

(b) The responsible employer ***must*** provide respirators to, and ensure that they are used by, all workers who:

(1) Are exposed to an airborne concentration of beryllium at or above the action level, or

(2) Are performing tasks for which analyses indicate the potential for exposures at or above the action level.

(c) The responsible employer ***must*** include in the respiratory protection program any beryllium-associated worker who requests to use a respirator for protection against airborne beryllium, regardless of measured exposure levels.

(d) The responsible employer ***must*** select for use by workers:

(1) Respirators approved by the National Institute for Occupational Safety and Health (NIOSH) if NIOSH-approved respirators exist for a specific DOE task; or

(2) Respirators that DOE has accepted under the DOE Respiratory Protection Acceptance Program if NIOSH-approved respirators do not exist for specific DOE tasks.

§ 850.29 Protective clothing and equipment.

(a) The responsible employer ***must*** provide protective clothing and equipment to beryllium workers and ensure its appropriate use and maintenance, where dispersible forms of beryllium may contact worker's skin, enter openings in workers' skin, or contact workers' eyes, including where:

(1) Exposure monitoring has established that airborne concentrations of beryllium are at or above the action level;

(2) Surface contamination levels measured or presumed prior to initiating work are above the level prescribed in §850.30;

(3) Surface contamination levels results obtained to confirm housekeeping efforts are above the level prescribed in §850.30; and

(4) Any beryllium-associated worker who requests the use of protective clothing and equipment for protection against airborne beryllium, regardless of measured exposure levels.

(b) The responsible employer ***must*** comply with 29 CFR 1910.132, Personal Protective Equipment General Requirements, when workers use personal protective clothing and equipment.

(c) The responsible employer ***must*** establish procedures for donning, doffing, handling, and storing protective clothing and equipment that:

(1) Prevent beryllium workers from exiting areas that contain beryllium with contamination on their bodies or their personal clothing; and

(2) Include beryllium workers exchanging their personal clothing for full-body protective clothing and footwear before they begin work in regulated areas.

(d) The responsible employer ***must*** ensure that no worker removes beryllium-contaminated protective clothing and equipment from areas that contain beryllium, except for workers authorized to launder, clean, maintain, or dispose of the clothing and equipment.

(e) The responsible employer ***must*** prohibit the removal of beryllium from protective clothing and equipment by blowing, shaking, or other means that may disperse beryllium into the air.

(f) The responsible employer ***must*** ensure that protective clothing and equipment is cleaned, laundered, repaired, or replaced as needed to maintain effectiveness. The responsible employer ***must***:

(1) Ensure that beryllium-contaminated protective clothing and equipment, when removed for laundering, cleaning, maintenance, or disposal, is placed in containers that prevent the dispersion of beryllium dust and that are labeled in accordance with §850.38 of this part; and

(2) Inform organizations that launder or clean DOE beryllium-contaminated protective clothing or equipment that exposure to beryllium is potentially harmful, and that clothing and equipment should be laundered or cleaned in a manner prescribed by the responsible employer to prevent the release of airborne beryllium.

§ 850.30 Housekeeping.

(a) Where beryllium is present in operational areas of DOE facilities, the responsible employer ***must*** conduct routine surface sampling to determine housekeeping conditions. Surfaces contaminated with beryllium dusts and waste ***must*** not exceed a removable contamination level of 3 μg/100 cm^2 during non-operational periods. This sampling would not include the interior of installed closed systems such as enclosures, glove boxes, chambers, or ventilation systems.

(b) When cleaning floors and surfaces in areas where beryllium is present at DOE facilities, the responsible employer ***must*** clean beryllium-contaminated floors and surfaces using a wet method, vacuuming or other

cleaning methods, such as sticky tack cloths, that avoid the production of airborne dust. Compressed air or dry methods ***must*** not be used for such cleaning.

(c) The responsible employer ***must*** equip the portable or mobile vacuum units that are used to clean beryllium-contaminated areas with HEPA filters, and change the filters as often as needed to maintain their capture efficiency.

(d) The responsible employer ***must*** ensure that the cleaning equipment that is used to clean beryllium-contaminated surfaces is labeled, controlled, and not used for non-hazardous materials.

§ 850.31 Release criteria.

(a) The responsible employer ***must*** clean beryllium-contaminated equipment and other items to the lowest contamination level practicable, but not to exceed the levels established in paragraphs (b) and (c) of this section, and label the equipment or other items, before releasing them to the general public or a DOE facility for non-beryllium use, or to another facility for work involving beryllium.

(b) Before releasing beryllium-contaminated equipment or other items to the general public or for use in a non-beryllium area of a DOE facility, the responsible employer ***must*** ensure that:

(1) The removable contamination level of equipment or item surfaces does not exceed the higher of 0.2 µg/100 cm^2 or the concentration level of beryllium in soil at the point or release, whichever is greater;

(2) The equipment or item is labeled in accordance with §850.38(b); and

(3) The release is conditioned on the recipient's commitment to implement controls that will prevent foreseeable beryllium exposure, considering the nature of the equipment or item and its future use and the nature of the beryllium contamination.

(c) Before releasing beryllium-contaminated equipment or other items to another facility performing work with beryllium, the responsible employer ***must*** ensure that:

(1) The removable contamination level of equipment or item surfaces does not exceed 3 µg/100 cm^2;

(2) The equipment or item is labeled in accordance with §850.38(b); and

(3) The equipment or item is enclosed or placed in sealed, impermeable bags or containers to prevent the release of beryllium dust during handling and transportation.

§ 850.32 Waste disposal.

(a) The responsible employer ***must*** control the generation of beryllium-containing waste, and beryllium-contaminated equipment and other items that are disposed of as waste, through the application of waste minimization principles.

(b) Beryllium-containing waste, and beryllium-contaminated equipment and other items that are disposed of as waste, ***must*** be disposed of in sealed, impermeable bags, containers, or enclosures to prevent the release of beryllium dust during handling and transportation. The bags, containers, and enclosures that are used for disposal of beryllium waste ***must*** be labeled according to §850.38.

§ 850.33 Beryllium emergencies.

(a) The responsible employer ***must*** comply with 29 CFR 1910.120(l) for handling beryllium emergencies related to decontamination and decommissioning operations.

(b) The responsible employer ***must*** comply with 29 CFR 1910.120(q) for handling beryllium emergencies related to all other operations.

§ 850.34 Medical surveillance.

(a) General.

(1) The responsible employer ***must*** establish and implement a medical surveillance program for beryllium-associated workers who voluntarily participate in the program.

(2) The responsible employer ***must*** designate a Site Occupational Medical Director (SOMD) who is responsible for administering the medical surveillance program.

(3) The responsible employer ***must*** ensure that the medical evaluations and procedures required by this section are performed by, or under the supervision of, a licensed physician who is familiar with the health effects of beryllium.

(4) The responsible employer ***must*** establish, and maintain, a list of beryllium-associated workers who may be eligible for protective measures under this part. The list ***must*** be:

(i) Based on the hazard assessment, exposure records, and other information regarding the identity of beryllium-associated workers; and

(ii) Adjusted at regular intervals based on periodic evaluations of beryllium-associated workers performed under paragraph (b)(2) of this section;

(5) The responsible employer ***must*** provide the SOMD with the information needed to operate and administer the medical surveillance program, including the:

(i) List of beryllium-associated workers required by paragraph (a)(4) of this section;

(ii) Baseline inventory;

(iii) Hazard assessment and exposure monitoring data;

(iv) Identity and nature of activities or operations on the site that are covered under the CBDPP, related duties of beryllium-associated workers; and

(v) Type of personal protective equipment used.

(6) The responsible employer ***must*** provide the following information to the SOMD and the examining physician:

(i) A copy of this rule and its preamble;

(ii) A description of the worker's duties as they pertain to beryllium exposure;

(iii) Records of the worker's beryllium exposure; and

(iv) A description of the personal protective and respiratory protective equipment used by the worker in the past, present, or anticipated future use.

(b) Medical evaluations and procedures. The responsible employer ***must*** provide, to beryllium-associated workers who voluntarily participate in the medical surveillance program, the medical evaluations and procedures required by this section at no cost and at a time and place that is reasonable and convenient to the worker.

(1) Baseline medical evaluation. The responsible employer ***must*** provide a baseline medical evaluation to beryllium-associated workers. This evaluation ***must*** include:

(i) A detailed medical and work history with emphasis on past, present, and anticipated future exposure to beryllium;

(ii) A respiratory symptoms questionnaire;

(iii) A physical examination with special emphasis on the respiratory system, skin and eyes;

(iv) A chest radiograph (posterior-anterior, 14 x 17 inches) interpreted by a National Institute for Occupational Safety and Health (NIOSH) B-reader of pneumoconiosis or a board-certified radiologist (unless a baseline chest radiograph is already on file);

(v) Spirometry consisting of forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV1);

(vi) A Be-LPT; and

(vii) Any other tests deemed appropriate by the examining physician for evaluating beryllium-related health effects.

(2) Periodic evaluation.

(i) The responsible employer ***must*** provide to beryllium workers a medical evaluation annually, and to other beryllium-associated workers a medical evaluation every three years. The periodic medical evaluation ***must*** include:

(A) A detailed medical and work history with emphasis on past, present, and anticipated future exposure to beryllium;

(B) A respiratory symptoms questionnaire;

(C) A physical examination with emphasis on the respiratory system;

(D) A Be-LPT; and

(E) Any other medical evaluations deemed appropriate by the examining physician for evaluating beryllium-related health effects.

(ii) The responsible employer ***must*** provide to beryllium-associated workers a chest radiograph every five years.

(3) Emergency evaluation. The responsible employer ***must*** provide a medical evaluation as soon as possible to any worker who may have been exposed to beryllium because of a beryllium emergency. The medical evaluation ***must*** include the requirements of paragraph (b)(2) of this section.

(c) Multiple physician review. The responsible employer ***must*** establish a multiple physician review process for beryllium-associated workers that allows for the review of initial medical findings, determinations, or recommendations from any medical evaluation conducted pursuant to paragraph (b) of this section.

(1) If the responsible employer selects the initial physician to conduct any medical examination or consultation provided to a beryllium-associated worker, the worker may designate a second physician to:

(i) Review any findings, determinations, or recommendations of the initial physician; and

(ii) Conduct such examinations, consultations and laboratory tests, as the second physician deems necessary to facilitate this review.

(2) The responsible employer ***must*** promptly notify a beryllium-associated worker in writing of the right to seek a second medical opinion after the initial physician provided by the responsible employer conducts a medical examination or consultation.

(3) The responsible employer may condition its participation in, and payment for, multiple physician review upon the beryllium-associated worker doing the following within fifteen (15) days after receipt of the notice, or receipt of the initial physician's written opinion, whichever is later:

(i) Informing the responsible employer in writing that he or she intends to seek a second medical opinion; and

(ii) Initiating steps to make an appointment with a second physician.

(4) If the findings, determinations, or recommendations of the second physician differ from those of the initial physician, then the responsible employer and the beryllium-associated worker ***must*** make efforts to encourage and assist the two physicians to resolve any disagreement.

(5) If, despite the efforts of the responsible employer and the beryllium-associated worker, the two physicians are unable to resolve their disagreement, then the responsible employer and the worker, through their respective physicians, ***must*** designate a third physician to:

(i) Review any findings, determinations, or recommendations of the other two physicians; and

(ii) Conduct such examinations, consultations, laboratory tests, and consultations with the other two physicians, as the third physician deems necessary to resolve the disagreement among them.

(6) The SOMD ***must*** act consistently with the findings, determinations, and recommendations of the third physician, unless the SOMD and the beryllium-associated worker reach an agreement that is consistent with the recommendations of at least one of the other two physicians.

(d) Alternate physician determination. The responsible employer and the beryllium-associated worker or the worker's designated representative may agree upon the use of any alternate form of physician determination in lieu of the multiple physician review process provided by paragraph (c) of this section, so long as the alternative is expeditious and at least as protective of the worker.

(e) Written medical opinion and recommendation.

(1) Within two weeks of receipt of results, the SOMD ***must*** provide to the responsible employer a written, signed medical opinion for each medical evaluation performed on each beryllium-associated worker. The written opinion ***must*** take into account the findings, determinations and recommendations of the other examining physicians who may have examined the beryllium-associated worker. The SOMD's opinion ***must*** contain:

(i) The diagnosis of the worker's condition relevant to occupational exposure to beryllium, and any other medical condition that would place the worker at increased risk of material impairment to health from further exposure to beryllium;

(ii) Any recommendation for removal of the worker from DOE beryllium activities, or limitation on the worker's activities or duties or use of personal protective equipment, such as a respirator; and

(iii) A statement that the SOMD or examining physician has clearly explained to the worker the results of the medical evaluation, including all tests results and any medical condition related to beryllium exposure that requires further evaluation or treatment.

(2) The SOMD's written medical opinion ***must*** not reveal specific records, findings, and diagnoses that are not related to medical conditions that may be affected by beryllium exposure.

(f) Information provided to the beryllium-associated worker.

(1) The SOMD ***must*** provide each beryllium-associated worker with a written medical opinion containing the results of all medical tests or procedures, an explanation of any abnormal findings, and any recommendation that the worker be referred for additional testing for evidence of CBD, within 10 working days after the SOMD's receipt of the results of the medical tests or procedures.

(2) The responsible employer ***must***, within 30 days after a request by a beryllium-associated worker, provide the worker with the information the responsible employer is required to provide the examining physician under paragraph (a)(6) of this section.

(g) Reporting. The responsible employer ***must*** report on the applicable OSHA reporting form beryllium

sensitization, CBD, or any other abnormal condition or disorder of workers caused or aggravated by occupational exposure to beryllium.

(h) Data analysis.

(1) The responsible employer ***must*** routinely and systematically analyze medical, job, and exposure data with the aim of identifying individuals or groups of individuals potentially at risk for CBD and working conditions that are contributing to that risk.

(2) The responsible employer ***must*** use the results of these analyses to identify additional workers to whom the responsible employer ***must*** provide medical surveillance and to determine the need for additional exposure controls.

§ 850.35 Medical removal.

(a) Medical removal protection. The responsible employer ***must*** offer a beryllium-associated worker medical removal from exposure to beryllium if the SOMD determines in a written medical opinion that it is medically appropriate to remove the worker from such exposure. The SOMD's determination ***must*** be based on one or more positive Be-LPT results, chronic beryllium disease diagnosis, an examining physician's recommendation, or any other signs or symptoms that the SOMD deems medically sufficient to remove a worker.

(1) Temporary removal pending final medical determination. The responsible employer ***must*** offer a beryllium-associated worker temporary medical removal from exposure to beryllium on each occasion that the SOMD determines in a written medical opinion that the worker should be temporarily removed from such exposure pending a final medical determination of whether the worker should be removed permanently.

(i) In this section, ''final medical determination'' means the outcome of the multiple physician review process or the alternate medical determination process provided for in paragraphs (c) and (d) of §850.34.

(ii) If a beryllium-associated worker is temporarily removed from beryllium exposure pursuant to this section, the responsible employer ***must*** transfer the worker to a comparable job for which the worker is qualified (or for which the worker can be trained in a short period) and where beryllium exposures are as low as possible, but in no event at or above the action level.

(iii) The responsible employer ***must*** maintain the beryllium-associated worker's total normal earnings, seniority, and other worker rights and benefits as if the worker had not been removed.

(iv) If there is no such job available, the responsible employer ***must*** provide to the beryllium-associated worker the medical removal protection benefits specified in paragraph (b)(2) of this section, until a job becomes available or for one year, whichever comes first.

(2) Permanent medical removal.

(i) The responsible employer ***must*** offer a beryllium-associated worker permanent medical removal from exposure to beryllium if the SOMD determines in a written medical opinion that the worker should be permanently removed from exposure to beryllium.

(ii) If a beryllium-associated worker is removed permanently from beryllium exposure based on the SOMD's recommendation pursuant to this section, the responsible employer ***must*** provide the worker the medical removal protection benefits specified in paragraph (b) of this section.

(3) Worker consultation before temporary or permanent medical removal. If the SOMD determines that a beryllium-associated worker should be temporarily or permanently removed from exposure to beryllium, the SOMD ***must***:

(i) Advise the beryllium-associated worker of the determination that medical removal is necessary to protect the worker's health;

(ii) Provide the beryllium-associated worker with a copy of this rule and its preamble, and any other information the SOMD deems necessary on the risks of continued exposure to beryllium and the benefits of removal;

(iii) Provide the beryllium-associated worker the opportunity to have any questions concerning medical removal answered; and

(iv) Obtain the beryllium-associated worker's signature acknowledging that the worker has been advised to accept medical removal from beryllium exposure as provided in this section, and has been provided with the information specified in this paragraph, on the benefits of removal and the risks of continued exposure to beryllium.

(4) Return to work after medical removal.

(i) The responsible employer, subject to paragraph (a)(4)(ii) of this section, ***must*** not return a beryllium-associated worker who has been permanently removed under this section to the worker's former job status unless the SOMD first determines in a written medical opinion that continued medical removal is no longer necessary to protect the worker's health.

(ii) Not withstanding paragraph (a)(4)(i) of this section, if, in the SOMD's opinion, continued exposure to beryllium will not pose an increased risk to the beryllium-associated worker's health, and medical removal is an inappropriate remedy in the circumstances, the SOMD ***must*** fully discuss these matters with the worker and then, in a written determination, may authorize the responsible employer to return the worker to his or her former job status. Thereafter, the returned beryllium-associated worker ***must*** continue to be provided with medical surveillance under §850.34 of this part.

(b) Medical removal protection benefits.

(1) If a beryllium-associated worker has been permanently removed from beryllium exposure pursuant to paragraph (a)(2) of this section, the responsible employer ***must*** provide the beryllium-associated worker:

(i) The opportunity to transfer to another position which is available, or later becomes available, for which the beryllium-associated worker is qualified (or for which the worker can be trained in a short period) and where beryllium exposures are as low as possible, but in no event at or above the action level; or

(ii) If the beryllium-associated worker cannot be transferred to a comparable job where beryllium exposures are below the action level, a maximum of 2 years of permanent medical removal protection benefits (specified in paragraph (b)(2) of this section).

(2) If required by this section to provide medical removal protection benefits, the responsible employer ***must*** maintain the removed worker's total normal earnings, seniority and other worker rights and benefits, as though the worker had not been removed.

(3) If a removed beryllium-associated worker files a claim for workers' compensation payments for a beryllium-related disability, then the responsible employer ***must*** continue to provide medical removal protection benefits pending disposition of the claim. The responsible employer ***must*** receive no credit for the workers' compensation payments received by the worker for treatment related expenses.

(4) The responsible employer's obligation to provide medical removal protection benefits to a removed beryllium-associated worker is reduced to the extent that the worker receives compensation for earnings lost during the period of removal either from a publicly- or employer-funded compensation program, or from employment with another employer made possible by virtue of the worker's removal.

(5) For the purposes of this section, the requirement that a responsible employer provide medical removal protection benefits is not intended to expand upon, restrict, or change any rights to a specific job classification or position under the terms of an applicable collective bargaining agreement.

(6) The responsible employer may condition the provision of medical removal protection benefits upon the beryllium-associated worker's participation in medical surveillance provided in accordance with §850.34 of this part.

§ 850.36 Medical consent.

(a) The responsible employer ***must*** provide each beryllium-associated worker with a summary of the medical surveillance program established in §850.34 at least one week before the first medical evaluation or procedure or at any time requested by the worker. This summary ***must*** include:

(1) The type of data that will be collected in the medical surveillance program;

(2) How the data will be collected and maintained;

(3) The purpose for which the data will be used; and

(4) A description of how confidential data will be protected.

(b) Responsible employers ***must*** also provide each beryllium-associated worker with information on the benefits and risks of the medical tests and examinations available to the worker at least one week prior to any such examination or test, and an opportunity to have the worker's questions answered.

(c) The responsible employer ***must*** have the SOMD obtain a beryllium-associated worker's signature on the informed consent form found in Appendix A to this part, before performing medical evaluations or any tests.

§ 850.37 Training and counseling.

(a) The responsible employer ***must*** develop and implement a beryllium training program and ensure participation for:

(1) Beryllium-associated workers;

(2) All other individuals who work at a site where beryllium activities are conducted.

(b) The training provided for workers identified in paragraph (a)(1) of this section, ***must***:

(1) Be in accordance with 29 CFR 1910.1200, Hazard Communication;

(2) Include the contents of the CBDPP; and

(3) Include potential health risks to beryllium worker family members and others who may come in contact with beryllium on beryllium workers or beryllium workers' personal clothing or other personal items as the result of a beryllium control failure at a DOE facility.

(c) The training provided for workers identified in paragraph (a)(2) of this section ***must*** consist of general awareness about beryllium hazards and controls.

(d) The responsible employer ***must*** provide the training required by this section before or at the time of initial assignment and at least every two years thereafter.

(e) The employer ***must*** provide retraining when the employer has reason to believe that a beryllium worker lacks the proficiency, knowledge, or understanding needed to work safely with beryllium, including at least the following situations:

(1) To address any new beryllium hazards resulting from a change to operations, procedures, or beryllium controls about which the beryllium worker was not previously trained; and

(2) If a beryllium worker's performance involving beryllium work indicates that the worker has not retained the requisite proficiency.

(f) The responsible employer ***must*** develop and implement a counseling program to assist beryllium-associated workers who are diagnosed by the SOMD to be sensitized to beryllium or to have CBD. This counseling program ***must*** include communicating with beryllium-associated workers concerning:

(1) The medical surveillance program provisions and procedures;

(2) Medical treatment options;

(3) Medical, psychological, and career counseling;

(4) Medical benefits;

(5) Administrative procedures and workers rights under applicable Workers' Compensation laws and regulations;

(6) Work practice procedures limiting beryllium-associated worker exposure to beryllium; and

(7) The risk of continued beryllium exposure after sensitization.

§ 850.38 Warning signs and labels.

(a) Warning signs. The responsible employer ***must*** post warning signs at each access point to a regulated area with the following information:

DANGER

BERYLLIUM CAN CAUSE LUNG DAMAGE

CANCER HAZARD

AUTHORIZED PERSONNEL ONLY

(b) Warning labels.

(1) The responsible employer ***must*** affix warning labels to all containers of beryllium, beryllium compounds, or beryllium-contaminated clothing, equipment, waste, scrap, or debris.

(2) Warning labels ***must*** contain the following information:

DANGER

CONTAMINATED WITH BERYLLIUM

DO NOT REMOVE DUST BY BLOWING OR SHAKING

CANCER AND LUNG DISEASE HAZARD

(c) Warning signs and labels ***must*** be in accordance with 29 CFR 1910.1200, Hazard Communication.

§ 850.39 Recordkeeping and use of information.

(a) The responsible employer ***must*** establish and maintain accurate records of all beryllium inventory information, hazard assessments, exposure

measurements, exposure controls, and medical surveillance.

(b) Heads of DOE Departmental Elements ***must***:

(1) Designate all record series as required under this rule as agency records and, therefore, subject to all applicable agency records management and access laws; and

(2) Ensure that these record series are retained for a minimum of seventy-five years.

(c) The responsible employer ***must*** convey to DOE or its designee all record series required under this rule if the employer ceases to be involved in the CBDPP.

(d) The responsible employer ***must*** link data on workplace conditions and health outcomes in order to establish a basis for understanding the beryllium health risk.

(e) The responsible employer ***must*** ensure the confidentiality of all work-related records generated under this rule by ensuring that:

(1) All records that are transmitted to other parties do not contain names, social security numbers or any other variables, or combination of variables, that could be used to identify particular individuals; and

(2) Individual medical information generated by the CBDPP is:

(i) Either included as part of the worker's site medical records and maintained by the SOMD, or is maintained by another physician designated by the responsible employer;

(ii) Maintained separately from other records; and

(iii) Used or disclosed by the responsible employer only in conformance with any applicable requirements imposed by the Americans with Disabilities Act, the Privacy Act of 1974, the Freedom of Information Act, and any other applicable law.

(f) The responsible employer ***must*** maintain all records required by this part in current and accessible electronic systems, which include the ability readily to retrieve data in a format that maintains confidentiality.

(g) The responsible employer ***must*** transmit all records generated as required by this rule, in a format that protects the confidentiality of individuals, to the DOE Assistant Secretary for Environment, Safety and Health on request.

(h) The responsible employer ***must*** semi-annually transmit to the DOE Office of Epidemiologic Studies within the Office of Environment, Safety and Health an electronic registry of beryllium-associated workers that protects confidentiality, and the registry ***must*** include, but is not limited to, a unique identifier, date of birth, gender, site, job history, medical screening test results, exposure measurements, and results of referrals for specialized medical evaluations.

§ 850.40 Performance feedback.

(a) The responsible employer ***must*** conduct periodic analyses and assessments of monitoring activities, hazards, medical surveillance, exposure reduction and minimization, and occurrence reporting data.

(b) To ensure that information is available to maintain and improve all elements of the CBDPP continuously, the responsible employer ***must*** give results of periodic analyses and assessments to the line managers, planners, worker protection staff, workers, medical staff, and labor organizations representing beryllium-associated workers who request such information.

Appendix A to Part 850—Chronic Beryllium Disease Prevention Program Informed Consent Form

I, _____ have carefully read and understand the attached information about the Be-LPT and other medical tests. I have had the opportunity to ask any questions that I may have had concerning these tests. I understand that this program is voluntary and I am free to withdraw at any time from all or any part of the medical surveillance program. I understand that the tests are confidential, but not anonymous. I understand that if the results of any test suggest a health problem, the examining physician will discuss the matter with me, whether or not the result is related to my work with beryllium. I understand that my employer will be notified of my diagnosis only if I have a beryllium sensitization or chronic beryllium disease. My employer will not receive the results or diagnoses of any health conditions not related to beryllium exposure.

I understand that, if the results of one or more of these tests indicate that I have a health problem that is related to beryllium, additional examinations will be recommended. If additional tests indicate I do have a beryllium sensitization or CBD, the Site Occupational Medical Director may recommend that I be removed from working with beryllium. If I agree to be removed, I understand that I may be transferred to another job for which I am qualified (or can be trained for in a short period) and where my beryllium exposures will be as low as possible, but in no case above the action level. I will maintain my total normal earnings,

seniority, and other benefits for up to two years if I agree to be permanently removed.

I understand that if I apply for another job or for insurance, I may be requested to release my medical records to a future employer or an insurance company.

I understand that my employer will maintain all medical information relative to the tests performed on me in segregated medical files separate from my personnel files, treated as confidential medical records, and used or disclosed only as provided by the Americans with Disability Act, the Privacy Act of 1974, or as required by a court order or under other law.

I understand that the results of my medical tests for beryllium will be included in the Beryllium Registry maintained by DOE, and that a unique identifier will be used to maintain the confidentiality of my medical information. Personal identifiers will not be included in any reports generated from the DOE Beryllium Registry. I understand that the results of my tests and examinations may be published in reports or presented at meetings, but that I will not be identified.

I consent to having the following medical evaluations:

/ / Physical examination concentrating on my lungs and breathing

/ / Chest X-ray

/ / Spirometry (a breathing test)

/ / Blood test called the beryllium-induced lymphocyte proliferation test or Be-LPT

/ / Other test(s). Specify: _____

Signature of Participant: _____

Date: _____

I have explained and discussed any questions that the employee expressed concerning the Be-LPT, physical examination, and other medical testing as well as the implications of those tests.

Name of Examining Physician: _____

Signature of Examining Physician: _____

Dated: _____

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Appendix B. Baseline Beryllium Inventory

The table, "Buildings where Beryllium Work has been Performed," on the following page is the starting point for determining the baseline beryllium inventory. The basis for this table is the Hazards Control Analytical Laboratory database (ALIMS) for air and surface (swipe) samples and it covers the years 1962 – 1998. The basic assumption made is that if a beryllium sample was taken in a building, room, or on a piece of equipment some amount of beryllium work was done or presence of beryllium contaminated equipment was expected. This assumption is true in the majority of cases; however, beryllium analysis is part of a analytical suite ("California 17 metals," "Pump Metals," "IH metals") and is done automatically, even if beryllium is not present. It is not possible to sort these data from the rest.

In mid-1999 the GAO requested a audit of DOE beryllium activities, the ALIMS database was used to identify buildings and the number of air and swipe samples taken during the 1962 – 1998 period was taken a measure of the amount of beryllium related work done. See this report for specifics.[42]

The major work was done in the following buildings:

231 Mechanical Engineering
241 Chemistry and Material Science Laboratories
321C Machine Shop for Toxic and Radioactive Materials

Lessor amounts of work were done in or at the following buildings and areas:

131 Engineering
235 Chemistry and Materials Science
391 Lasers
419 Hazardous Waste Management (formerly Decontamination Facility)
619 DUS Salvage Yard
801 Site-300 Firing Bunker
851 Site-300 Firing Bunker

[42] LLNL response to GAO Audit, August 1999.

Table. Buildings where Beryllium Work has been Performed

102	226	323	513	822
111	227	324	514	822B
113	228	325	514A	823
121	229	326	516	823B
131	231	327	523	824
132N	232	328	545	826
132S	233	329	551W	827
134	234	331	554	827D
141	235	332	591	828
151	239	340	612	829
153	241	341	614	830
154	243	343	615	831
161	248	345	616	832
162	251	350	617B	834
165	253	351	618	836
165A	254	352	619	840
166	255	362	630	841
167	255W	366	652	843B
168	261	376	663	845
169	281	378	691	850
171	291	381	801	851
172	292	383	802	851B
173	294	391	803	852
174	298	392	804	852B
175	300	401	805	854
176	301	402	806	854F
177	302	403	807	855
181	310	404	808	856
182	311	405	809	857
191	312	411	809A	858
194	313	412	809B	859
196	314	416	810	860
197	315	417	812	861
212	316	418	812E	865
213	320	419	814	871
219	321A	431	816	874
221	321B	432	817	875
222	321C	435	818	877
223	321E	490	819	879
224	321W	494	820	880
225	322	511	821	897

Appendix C. Current Beryllium Operations

This table lists operations that are currently being performed, or are planned. Three directorates, Biology and Biotechnology Research, Computations, and Energy Programs have no beryllium work; these are included in this table for completeness.

Directorate	Location	Description	LLNL Safety Document
Biology & Biotechnology Research		None	
Chemistry & Material Science	B-132N (Rooms 2691, 2699, 2671, 2675, 2679, 2680, 2894)	Research: beryllium metals, chemical analysis of beryllium and materials containing beryllium maintenance of equipment. Beryllium articles are handled in sol-gel and aerogel preparation.	FSP 132N
Chemistry & Material Science	B-151 (Rooms 1033, 1318, 1326, 1334B, 2117, 2121, 2121A, 2322, 2326, 2326A, 2330, 2330A, 2348, 2348A, 2350, 2350A, 2109, 2109B, 2143, 2147, 2147A, 2149A, 2149B, 1401A, B-114, B-114A, and B-114B) B-154 (Rooms 1012 and 1025)	Research, chemical analysis of beryllium and materials containing beryllium, maintenance of equipment. Beryllium articles are handled in B-154.	FSP 151/154
Chemistry & Material Science	191 (Room 1500)	Beryllium articles are examined via Scanning Electron Microscope.	FSP 191
Chemistry & Material Science	222, 227	Spot characterization and de-contamination in support of D&D project.	
Chemistry & Material Science	231 (Rooms 1945A, B, C, D, E F, and 1427)	Metallography Laboratory. Non-destructive handling of prepared beryllium samples.	FSP 231, OSP 231.139
Chemistry &	235 (Rooms 1131,	Research, beryllium metallurgy,	FSP 235

Directorate	Location	Description	LLNL Safety Document
Material Science	1138, 1215, 1251, basement)	beryllium coating, sputtering, inspection of beryllium under electron microscopes, ion implanter, accelerator, maintenance of equipment and facilities. Storage of beryllium metal.	
Chemistry & Material Science	241 (Rooms 1600, 1825, 1826, 1838, 1886, 1901)	Legacy equipment present in High Bay, vault, and ventilation systems. Decommissioning of obsolete equipment. Storage of beryllium stock for x-ray windows. Previous activities: research, beryllium metal and compounds (including oxide), sputtering, machining, maintenance of equipment and facilities.	FSP 241
Chemistry & Material Science	Site-300 Process and Chemistry Areas, Buildings 805, 806A, 806B, 807, 809, 810, 817, 823B, 825, 826, and 827	Research, machining, radiography, inspection and assembly of explosives and non-explosives parts containing solid beryllium. Maintenance on equipment that may contain beryllium contamination.	Chemistry Area FSP; Process Area FSP; B809 & B-823 FSP
Computations		None.	
Defense & Nuclear Technologies	NTS (Field Test Areas)	Research: inspection, assembly of explosive and non-explosive parts containing beryllium components; explosive tests.	FSP for the "BEEF" Facility is currently under development. All LLNL activities at NTS fall under the requirements of the ES&H Manual, with specific requirements in Volume 6, "Nevada Requirements"
Defense & Nuclear Technologies	Off-site Locations (such as Pantex, or Y-12)	Research: this includes sites where LLNL has primary responsibility (covered by the CBDPP) and other DOE contractor sites where LLNL employees will be covered	Separate OSPs and IWSs will be developed to address hazards specific to indi-

Directorate	Location	Description	LLNL Safety Document
		by that site's CBDPP.	vidual areas where LLNL has primary responsibility prior to performing work.
Defense & Nuclear Technologies	Site-300 (Bldgs, 801, 804, 812, 850, 851 and Firing Tables)	Research, hydrodynamic testing (test assemblies may contain beryllium components; firing tables: set-up of tests, post-test clean-up), maintenance of equipment (which may include beryllium articles) and facilities. [Potential for regulated beryllium work area exists depending on activity.] Proposed operation (under construction): Contained Firing Facility (operations will be similar to firing tables process, but in an enclosed chamber).	FSP S300.1
Defense & Nuclear Technologies	Superblock (B-331 and B-332)	Research; facility and equipment maintenance, HEPA filter testing, decontamination and decommissioning of obsolete equipment. Majority of work is performed in gloveboxes for control of other hazards.	FSP 331, FSP 332
Deputy Director for Operations / Institution	Various	Decontamination, decommission and demolition of excessed facilities where beryllium work may have been done.	Separate OSPs and IWSs will be developed to address hazards specific to individual areas prior to performing work.
Earth & Environmental Science	190	Milligram quantities of BeO are used to produce ion beams.	FSP 190
Earth & Environmental Science	292 (Room 1008)	Accelerator Mass Spectroscopy: sample preparation.	OSP 292.14
Earth & Environmental Science	294 (Rooms 1, 1000A)	Accelerator Mass Spectroscopy: sample preparation: dissolution of samples with mineral acids, addition of $Be(NO_3)_2$, and conversion to BeO; maintenance of equipment. Amounts of beryllium	OSP 294.01

Directorate	Location	Description	LLNL Safety Document
		used are typically in the milligram range; amounts in storage are up to approximately 50 grams.	
Energy Programs		None.	
Engineering	131 (Hibay)	The assembly, environmental testing, disassembly and inspection of components containing beryllium parts. Receive parts for inspection and other programmatic work (which may contain beryllium or beryllium contamination) from other DOE contractor sites.	FSP 131
Engineering	141 (Room 107)	Molecular Beam Epitaxy (MBE): coating of wafers with layer(s) of other materials on controlled chemical composition by chemical reaction in a vacuum chamber. Maintenance of chamber and system. Approximately 1 gram of Be is stored in a crucible in the MBE.	OSP 141.27
Engineering	231 (1500 Area)	Vacuum Processes Laboratory: coating of non-beryllium materials onto beryllium substrates in a vacuum chamber, maintenance of coating chambers and systems.	FSP 231
Engineering	231 (1700 Area)	Weld Development Laboratory: authorized work includes resistance, friction, electron beam, gas tungsten arc, or gas metal arc welding; surface preparation, inspection, and solder/torch brazing; maintenance of equipment.	FSP 231, Appendix E
Engineering	231 (Rooms 1600, 1640. 1829, 1841, 1867)	Mechanical testing of beryllium parts; maintenance of equipment used for testing	OSP 231.136
Engineering	231 (Rooms 1963, 1963A)	Brazing and solid state bonding of beryllium in a vacuum chamber, rinsing and etching of parts; maintenance of equipment,	FSP 231, Appendix F
Engineering	239 (Radiography Bays)	Radiography of beryllium containing parts. These parts, when surface concentrations of removal beryllium are below the	FSP 239

Directorate	Location	Description	LLNL Safety Document
		0.2µg/100cm^2 criteria, are articles and as such are exempt from 10 CFR 850.	
Engineering	321A (Room 1001A)	Heat Treat Shop: heat treating and processing of beryllium parts.	FSP 321 Complex
Engineering	321C (NC Shop)	NC Shop: machining of beryllium and beryllium oxide. Cleaning of machined parts. Maintenance of equipment and systems; collection of waste.	FSP 321 Complex
Engineering	321C (Room 1351A)	Operation to machine BeO is inactive and not planned for reactivation, but potentially contaminated machine tool is still present.	OSP 321.83, expired 3/99
Engineering	321C (Room 1352)	Inspection Shop: inspection of finished parts of beryllium or beryllium oxide.	FSP 321 Complex
Engineering	322 (CEP Shop: 100, 109, 111)	Chemical and Electrochemical Processes Shop: chemical and electrochemical etching, or cleaning of beryllium-containing parts (soluble beryllium compounds may end up in tanks).	FSP 321 Complex, Appendix H
Engineering	327 (Room 1275)	NDE Shop: Non-destructive evaluation of beryllium and beryllium oxide parts, maintenance of equipment and facilities. These parts, when surface concentrations of removal beryllium are below the 0.2µg/100cm^2 criteria, are articles and as such are exempt from 10 CFR 850.	FSP 327
Engineering	329 (various rooms)	Laser welding of hazardous materials including beryllium.	FSP 321 Complex and HAC
Engineering	Sitewide (Machine Tool Services)	Maintenance, repair, installation, and removal of machine tools that may contain beryllium.	FSP 321 Complex
Engineering	Storage Vaults: 131 Vault (rooms 1341 & 1341A), 231 Vault (1300 area), 232 (fenced	Storage and limited handling of packaged beryllium material or parts.	FSP 131 FSP 231Vault FSP 233 & 232 Fenced Area

Directorate	Location	Description	LLNL Safety Document
	area), 233 Vault, 321C Vault (room 1347A)		FSP 321 Complex
Laboratory Site Operations	Sitewide (Hazardous Waste Management)	Handling and processing of hazardous and mixed waste that contains beryllium, beryllium compounds and items contaminated with beryllium. Waste is sampled and picked up from Satellite Waste Accumulation Areas and processed through HWM facilities. Selected operations (some liquid waste treatment and storage) will be relocated to DWTF from existing facilities.	FSP 514, FSP 612, HAC
Laboratory Site Operations	Sitewide (Hazards Control Department)	ES&H support of programmatic work involving beryllium (inspection, oversight, air and surface sampling, HEPA filter testing, chemical analysis in B-253), assist programs in facility and equipment maintenance.	FSP 253
Laboratory Site Operations	Sitewide (Plant Engineering)	Facility maintenance of structures (buildings) and systems (ventilation, plumbing, and other facility systems) used to control hazardous materials (including beryllium).	Operations are covered in generic IWS's, bridging documents for specific facilities are written as necessary
Lasers	162 (Rooms 1104, 1106, 1107, 1201, 1201A, 1201B, 1202, 1202A, 1208, 2210, 2301) and 164 (all)	Growth of laser crystals in moderate and high temperature furnaces (inductively coupled or resistance heated). Synthesis of various inorganic compounds for laser host applications. Operations include grinding, mixing, melting, blending, weighing, and assembly of powders into boats, capsules, ampoules, and crucibles. 5 kg BeF_2 and BeO stored in Room 162/2301.	OSP 162 supplement 11
Lasers	197 (Room 10123)	Plating of beryllium/copper alloy test strips (strips are handled intact with cutting or abrading) with	HAC

Directorate	Location	Description	LLNL Safety Document
		various metals.	
Lasers	298 (184, 185, 187, and 188)	Laser cutting and drilling: cutting and/or drilling of beryllium foils is performed in a vacuum chamber.	OSP 298.09
Lasers	298 (Rooms 102, 103, 106, 107, 108, 109, 112, 142, 143, 144, 145, 148, 181, 183, 189, 190, 191, 192, 193)	Laser target development, fabrication, and characterization: operation and maintenance of various types of high frequency coaters and sources, plasma strippers, induction heaters, x-ray equipment, scanning electron microscopes, and the handling radioactive and toxic (including beryllium) materials. 3 kg of Be in storage (25 g in use).	OSP 298.25
Lasers	391 (Room 1304B)	Beryllium Coating Facility: coating of parts with beryllium in a vacuum chamber, maintenance of coating chamber and system. Beryllium is present as an anode (1 anode present in coater, 1-4 anodes in storage).	OSP 391.44
Lasers	NIF (Planned Beryllium Operation)	Beryllium will be present in diagnostic windows and target shells. Experiments leading to goal of controlled thermonuclear fusion by imploding and igniting a target capsule. Work will require entry of target chamber for experiment set-up and system maintenance.	NIF Draft Preliminary Safety Analysis Report
Non-Proliferation, Arms Control, International Security	132S, 261	Beryllium articles: sealed sources with beryllium and windows in x-ray machines.	FSP 132S
Physics	121 (Rms. 1118, 1126A, and 1210)	Physics research (beryllium foil used to make windows is incidental to other work), maintenance of equipment. Be storage (rooms 1126A and 1210).	FSP 121
Physics	194 and 212	Physics research, maintenance of equipment. Beryllium windows as articles are used in equipment. Note: work in B-212 is moving to Bldgs. 132S, 194, and 341.	FSP 194, FSP 212
Various	Off-site	Emergency response. This activity	n/a.

Directorate	Location	Description	LLNL Safety Document
Directorates		is under management by DOE Albuquerque and is subject to their CBDPP when there is a potential for beryllium exposure.	

Appendix D. Timeline for Action Items

Action Item	Date
Specific Implementation Requirements	
Perform "initial monitoring" for operations that may have airborne beryllium	July 2001
Perform hazards assessments for all current beryllium work areas	Currently in progress; complete July 2001
Develop baseline beryllium inventory to list current operations and identify areas of potential contamination.	(1) Protocol: August 2000 (2) Inventory: January 2002
Perform hazard assessments in all former beryllium work areas	This will be done in concert with the inventory; completion January 2002
Implement required housekeeping program	This program will be formally implemented when the revised H&S Manual Supplement 21.10 is approved.
Establish database for information required by the Beryllium Registry (guidance is required from the DOE on specific data elements)	1 year after guidelines are received from DOE (estimate July 2001)
Develop a program review plan	1 year after CBDPP is approved (estimate July 2001)
Revisions to Medical surveillance Program	
Update beryllium medical surveillance program protocol	August 2000
Implement DOE-required consent form (pending DOE guidance on guarantees of worker confidentiality)	August 2000
Establish methodology for reviewing population at risk	August 2000
Implement OSHA reporting protocol for beryllium health effects (pending DOE guidance on guarantees of confidentiality)	August 2000
Update existing counseling program for sensitized and CBD-diagnosed workers	August 2000
Revisions to the ES&H Manual	
Chapter 10, "PPE," revision in progress; needs to be completed	September 2000 (Approved 5/30/00 and

Action Item	Date
	available online)
Supplement 21.10, "Safe Handling of Beryllium and Its Compounds," major revision required to reflect requirements of the rule (administrative controls, engineering controls, and personal protective equipment) to implement exposure reduction and minimization	Provide draft to ES&H Working Group mid-August 2000
Revise WAC to address the labeling requirements of 10 CFR 850	September 2000
Revise ES&H Manual, Volume III, Chapter 9 for beryllium waste	May 2001
Training Program Revisions	
Complete revision of Beryllium Worker Class	April 2001
Complete instructional design of Beryllium Worker Refresher Class	January 2002
Complete instructional design of new Beryllium Awareness Class (for all LLNL employees other than beryllium workers)	December 2000 (Complete: on line 7/10/2000)
Train all employees (LLNL and contractor): (1) Awareness training for all employees (2) Update beryllium worker training for beryllium workers and beryllium associated workers	Delivery will start with the completion of the course development as noted above and continue until complete.
Formalize counseling program	December 2000
Policy Revision	
Revise interim medical protection guideline to be consistent with the rule	January 2001
Revision to IH Program and Policy Documents	
Revise IH DAP element for monitoring beryllium work areas	August 2000
Revise IHPIM for reporting results of exposure measurements	August 2000

Appendix E. Exposure Data

This table, "Beryllium Exposure Measurements," provides results of personal sampling in the period 1993-2000. This data is not intended to meet the initial monitoring requirements of the Rule (only those data taken within 12 months prior to the effective date of 10 CFR 850, i.e., after January 7, 1999, satisfy this requirement). The purpose of this table is to illustrate the magnitude of beryllium exposure results in the last several years. The important point of this table is that many of the measurements, as 8-hour time weighted average exposures, are below the detection limit of the method, which is below the action level of 0.2 µg/m^3; short term samples are below the OSHA ceiling standard. There is only one case a single measurement exceeded 0.2 µg/m^3; other measurements taken of that same operation indicated an average exposure of <0.2 µg/m^3. This data is used to support some of the conclusions made in Section VI, "Exposure Reduction and Minimization."

Beryllium Exposure Measurements.

Bldg	Room	Title	Safety Document	Airborne exposure (µg/m^3, TWA)	Regulated Area (yes/no)
231	1700	FSP 231, App J (Weld Dev Lab) Exp. 12/96	FSP 231	<0.04; <0.03 note[43]	no
231	VPL and various	Ambient (General Area Air Samples)	n/a	6 @ <0.000174 to <0.000349 note[44]	no
231 Vault	Vault	Decontamination	HAC	2 @ 0.065 and <0.053 note[45]	no
235	1131	Clean & maintenance of Meyerburger cutoff saw	OSP 235.06; HAC	<0.109; <0.111 (30 min peak) note[46]	no
235	1131	HEPA filter maintenance		2 @ <0.0067 note[47]	no
235	1138	Equipment maintenance	HAC	2 @ <0.0067 note[48]	no
235	1215	Modification & maintenance of coating chamber	OSP 235.06; HAC	<0.008 note[49] <0.008 note[50] <0.016; 0.041 note[51] <0.0067 note[52]	no

[43] George P. Fulton to Bill Gourdin, January 31, 1996, "Results of Air Samples for Personal Exposure Beryllium Exposure During Welding"
[44] Bruce King to Steve Bryan, December 3, 1999, "B231 Beryllium General Area Air Monitoring Results – Oct. 1999"
[45] George Fulton to Susan Gagner, October 2, 1996. "Beryllium Exposure while Decontamination the Drum Opening Workstation"
[46] Ellen D. Anson to Bob Kershaw, September 25, 1997, "Beryllium Air Monitoring Results During Cleaning of the Meyerburger cut off saw in Building 235 Room 1131"
[47] Rick Kelly to Becky Failor and Rick Moniz, July 17, 1998, "Report of Beryllium Monitoring Results, Building 235 HEPA Filter Replacement"
[48] Rick Kelly to Becky Failor, August 27, 1998, "Report of Beryllium Monitoring Results, Building 235 HEPA Filter Replacement"

Bldg	Room	Title	Safety Document	Airborne exposure (µg/m³, TWA)	Regulated Area (yes/no)
				2 @ <0.0067 note[53]	
241	1600, 1825, 1826, 1838, 1886, 1901	FSP 241 App E v. 2 (Working w/ Be: solids, powders, processes-sputter coating, alloys-machining)	FSP 241	2 @ <0.53 (ceiling) note[54] <0.021 note[55]	no
241	Roof	Roof maintenance (leak repairs, contaminated equipment removal)	HAC	7 @ <0.02 note[56] "many" @ <0[57].02, 1 @ 0.03, note	no
298	various	Target Development, Fabrication and Characterization	OSP 298.25	<0.02 note[58]	no
321C	NC Shop	321 Machining (NC)	FSP 321; HAC	<0.09; <0.08; 0.18; 0.09; 0.14; 0.23 note[59] <0.008; 0.076 note[60] 0.0366 note[61] <0.0083 note[62]	no
321C	NC Shop	Tasks with Be or BeO other than	FSP 321	<0.05 note[63]	no

[49] Ellen D. Anson to Phil Ramsey, September 25, 1997, "Air Monitoring Results During Cleanout of a Beryllium Coating System (TM-1) in Building 235 Room 1215

[50] Rick Kelly to Steve Santor, May 21, 1998, "Report of Beryllium Monitoring Results, Building 235 Sputtering Equipment Cleanout"

[51] Rick Kelly to Steve Santor, May 6, 1999, "Report of Beryllium Monitoring Results, Installation of Be Sputtering Equipment in B235

[52] Rick Kelly to Steve Santor, May 6, 1999, "Report of Beryllium Monitoring Results, Installation of Be Sputtering Equipment in B235"

[53] Rick Kelly to Steve Santor, August 27, 1999, "Report of Beryllium Monitoring Results, Installation of Beryllium Sputtering Equipment in B235"

[54] Rick Kelly to Steve Santor, March 17, 1998, "Report of Beryllium Monitoring Results, Building 241 Sputtering"

[55] Rick Kelly to Bob Kershaw, June 9, 2000, "Report of Beryllium Monitoring Results, Cutting of Beryllium Metal in Building, Room 1131"

[56] Rick Kelly to Chuck Lewis, May 19, 2000, "Report of Beryllium Monitoring Results, Building 241 controlled Roof Patching"

[57] Rick Kelly to Mitch Waterman, April 18, 2000, "Report of Beryllium Monitoring Results, Building 241 Ventilation System Disassembly and Packaging" (this report is representative of several written at this time)

[58] Al Burer to Gary Hailey, March 31, 1998, "Air Samples for Beryllium in Bldg. 298, Rm. 189"

[59] Sarah Lane / Mark Costella to Rey Valentine, March 25, 1993, "Personal Sampling [name deleted] – Employee [number deleted]." This data is considered to be old and not representative of current exposures. Average of data subsequent to these measurements is <0.027 µg / m³.

[60] Robb Hadley to Dick Rose, April 2, 1999, "Beryllium Air Monitoring Results, B321C, NC Shop"

[61] Bruce King to Dick Rose, June 9, 1999, "Beryllium Air Monitoring Results for B321C-R1437 Machining at Lathe L341"

[62] Bruce King to Dick Rose, October 8, 1999, "Beryllium Air Monitoring Results for B321C-R1437 Machining at Lathe L3435 On 8 / 26 / 99" Note: these reports are representative; later reports show the same or similar results

Bldg	Room	Title	Safety Document	Airborne exposure ($\mu g/m^3$, TWA)	Regulated Area (yes/no)
		machining		0.006 note[64]	
321C	1351A	321 BeO (Piscotty)	OSP 321.83; HAC	<0.008 note[65]	no
329	various	329 Machining (Laser welding)	FSP 321; HAC	<0.035 note[66]	no
331	158	Glovebox decommissioning	HAC	2 @ <0.006 note[67] 2 @ <0.016 note[68]	no
391	1304B	OSP 391.44 Beryllium Coating Facility	OSP 391.44	2 @ <0.0392 note[69] note[70]	No
391	NOVA	Decommissioning of NOVA target chamber	HAC	<0.0667 note[71]	no
801		Firing Bunker maintenance (bull nose)	HAC	<0.02 note[72]	no
804		Firing Table Gravel Handling	HAC	4 @ <0.014-<0.017 note[73]	no
Site 300	Firing Tables	Firing Table Air Monitoring Results (set-up, clean-up, gravel removal, hillside soil sampling, surface swipe samples, washed		"approximately" 180 samples, 1 @ ~1/2 PEL, 2 @ >0.5 , the balance	Depends on activity; note[75]

[63] George P. Fulton to Greg Gleeson, August 29, 1997, "Report of Beryllium Exposure Results"
[64] Robb Hadley to Jimmy Utley, April 21, 1998, "Beryllium Results During Hand and Machine Lapping, B321C NC Shop"
[65] Robb Hadley to Joe Vargas, November 17, 1998, "Beryllium Air Monitoring Results, B321C/R1351A"
[66] George P. Fulton to Calvin Anglin, December 29, 1994, "Beryllium Exposure Results"
[67] Fred Cone to Mark Accatino, October 27, 1997, "Beryllium Exposures to Personnel During Removal of tubing and Duct Work Removal"
[68] Fred Cone to Mark Accatino, October 15, 1997, "Beryllium Exposures to Personnel During Removal of Containers from a Glovebox in Room 158"
[69] Al Buerer to Rick Behymer, June 20, 1998, "Air Sample for Beryllium in Bldg. 391, Rm. 1304" (sputtering)
[70] Al Buerer to Sasa Bajt, June 20, 1998, "Air Sampling Results for Beryllium in Bldg. 391, Rm. 1304" (breaking beryllium coated wafers)
[71] Al Burer to Tom Weiland, November 16, 1999, "Beryllium Air Monitoring in the NOVA Target Chamber"
[72] Fred Cone to Bruce Collins, May 18, 1999, "Beryllium Air Sampling – Building 801"
[73] Dave Zalk to Marty Svendson, April 21, 2000, "Personal Air Monitoring for Beryllium while Transferring Fire Table Gravel into Waste Containers"

Bldg	Room	Title	Safety Document	Airborne exposure ($\mu g/m^3$, TWA)	Regulated Area (yes/no)
		gravel samples, air samples)		(approx. 178) <0.2 note[74]	

[74] VC Lew, F Cone, and G Miller, "Firing Table Beryllium Air Monitoring Results," UCRL-JC-127324 (abstract), 1997

[75] Exposure potential depends on activity and specifics of the experiment. Experiment set-up: 48/71 samples < detection limit; clean-up, 16/25, < detection limit (excursions); pre/post shot work, 9/16 <detection limit (excursions); miscellaneous work, 29/32 < detection limit. "Excursions" are the three exposures greater than 0.2 $\mu g/m^3$, as noted above.

Appendix F. Comparison of LLNL Medical Surveillance Program with 10 CFR 850

The requirements are covered, in general, in the narrative of this CBDPP in Sections XIV, XV, XVI, XVII, XIX, and XX. However, due to the complexity and number of requirements of the Rule for medical surveillance, medical consent, medical removal protection, and counseling, as well as the medical specific record keeping and feedback aspects, these specific requirements of the Rule are addressed comprehensively in this Appendix.

Action Items and Time Line for resolution, as noted in the above cited sections, are enumerated in Appendix D.

Section	LLNL References/Comments
§ 850.34. Medical Surveillance.	See Section XIV of the LLNL CBDPP.
(a) Does the plan require or reference a voluntary medical surveillance program for beryllium-associated workers?	
(b) Does the plan designate a Site Occupational Medical Director (SOMD) who is responsible for administering the medical surveillance program.	The medical surveillance protocols are being updated to comply with the DOE rule
(c) Does the plan specify that the medical evaluations and procedures required by this section are performed by, or under the supervision of, a licensed physician who is familiar with the health effects of beryllium?	The SOMD and his designee is responsible for administering the program. The medical evaluations will be performed under the supervision of well trained MD's.
(d) Does the plan require that a list of beryllium-associated workers who may be eligible for protective measures under the plan be established and maintained?	The Hazards Control and Health Services Departments will jointly develop and maintain al list of eligible BAW's.
(e) Is the list of beryllium-associated workers:	
(1) Based on the hazard assessment, exposure records, and other information regarding the identity of beryllium-associated workers; and	
(2) Adjusted at regular intervals based on periodic evaluations of beryllium-associated workers performed under paragraph (b)(2) of this section;	The list of BAW's will be adjusted at regular intervals as new BAW's are identified in the field and as other BAW's leave LLNL service.
(f) Does the plan require that the SOMD be provided the information needed to operate and administer the medical surveillance program, including the:	The Hazards Control Department and other LLNL Departments as necessary will provide the SOMD information needed to manage the Be surveillance program
(1) List of beryllium-associated workers required by paragraph (a)(4) of this section;	including:
(2) Baseline inventory;	-Baseline inventory
(3) Hazard assessment and exposure monitoring data;	-HA and exposure monitoring data
(4) Identity and nature of activities or operations on the site that are covered under the CBDPP, related duties of beryllium-associated workers; and	-Identity and nature of activities covered under the CBDPP -Related duties of BAW's and
(5) Type of personal protective equipment used.	-Personal protective equipment

Section	LLNL References/Comments
(g) Does the plan require that the SOMD and the examining physician be provided the following:	The SOMD and his designee have been provided a copy of the rule The Hazards Control Department or the employee's supervisor, as appropriate, will provide other appropriate documents as listed:
(1) A copy of this rule and its preamble;	
(2) A description of the worker's duties as they pertain to beryllium exposure;	The employees supervisor will provide a description of the employee's duties related to beryllium.
(3) Records of the worker's beryllium exposure; and	Records of individual exposure will be provided by LLNL Hazards Control to the Health Services Dept.
(4) A description of the personal protective and respiratory protective equipment used by the worker in the past, present, or anticipated future use	The Hazards Control department will make information relating to personal protective and respiratory equipment available to Health Services
(h) Medical evaluations and procedures. Does the plan require that beryllium-associated workers who voluntarily participate in the medical surveillance program, be provided required medical evaluations and procedures at no cost and at a time and place that is reasonable and convenient to the worker?	BAW's will receive medical surveillance at HSD at no charge and at their convenience.
(1) Baseline medical evaluation. Does the plan require that baseline medical evaluation be provided to beryllium-associated workers that includes:	Baseline medical evaluations will be provided to BAW's that include history, respiratory questionnaires, an exam which emphasizes the respiratory system, skin and eyes, chest x-ray, spirometry, BeLPT, etc.
(i) A detailed medical and work history with emphasis on past, present, and anticipated future exposure to beryllium;	
(ii) A respiratory symptoms questionnaire;	
(iii) A physical examination with special emphasis on the respiratory system, skin and eyes;	
(iv) A chest radiograph (posterior-anterior, 14 x 17 inches) interpreted by a National Institute for Occupational Safety and Health (NIOSH) B-reader of pneumoconiosis or a board-certified radiologist (unless a baseline chest radiograph is already on file);	
(v) Spirometry consisting of forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV1);	
(vi) A Be-LPT; and	
(vii) Any other tests deemed appropriate by the examining physician for evaluating beryllium-related health effects.	
(2) Periodic evaluation. Does the plan require that:	
(i) Beryllium workers be provided a medical evaluation annually, and	Be Workers will be offered annual medical exams and testing as listed previously.

Section	LLNL References/Comments
(ii) Other beryllium-associated workers a medical evaluation every three years.	
(iii) The periodic medical evaluation must include:	BAW's will have evaluations every 3 years.
a A detailed medical and work history with emphasis on past, present, and anticipated future exposure to beryllium;	
b A respiratory symptoms questionnaire;	
c A physical examination with emphasis on the respiratory system;	
d A Be-LPT; and	
e Any other medical evaluations deemed appropriate by the examining physician for evaluating beryllium-related health effects.	
(iv) Does the plan require that beryllium-associated workers be offered chest radiograph every five years.	
(3) Emergency evaluation. Does the plan require that any worker who may have been exposed to beryllium because of a beryllium emergency be provided a medical evaluation at least equivalent to a periodic evaluation as soon as possible?	Health Services will provide a clinical evaluation to a worker who may have been exposed to Be in an emergency situation.
(i) Multiple physician review. Does the plan require a multiple physician review process for beryllium-associated workers that allows for the review of initial medical findings, determinations, or recommendations from any medical evaluation or procedure conducted under the plan.	Initial medical examinations will be provided by LLNL Health Services Department. The multiple MD review process will be available as an option for BAW's. This process will include review of initial medical findings and determinations. The plan will allow for the worker to designate a second MD to review clinical findings and perform evaluations as outlined in the Rule. The BAW will receive prompt written notification of this right.
(1) Does the plan specify the initial physician to conduct any medical examination or consultation provided to a beryllium-associated worker? If so:	
(i) Does the plan allow the worker to designate a second physician to:	The conditions for employers participation in and payment for multiple MD review will be outlined. The process for multiple physician in the Rule, including "tie-breaker" third opinions will conform with the requirements of the Rule.
a Review any findings, determinations, or recommendations of the initial physician; and	
b Conduct such examinations, consultations and laboratory tests, as the second physician deems necessary to facilitate this review?	
(ii) Does the plan require the prompt notification of a beryllium-associated worker in writing of the right to seek a	

Section	LLNL References/Comments
second medical opinion after the initial physician conducts a medical examination or consultation?	
(2) Does the plan condition the employer's participation in, and payment for, multiple physician review upon the beryllium-associated worker doing the following within fifteen (15) days after receipt of the notice, or receipt of the initial physician's written opinion, whichever is later:	
(i) Informing the responsible employer in writing that he or she intends to seek a second medical opinion; and	
(ii) Initiating steps to make an appointment with a second physician.	
(3) Does the plan require that the beryllium-associated worker and employer make efforts to encourage and assist the initial and second physician to resolve any disagreement in their findings, determinations?	The BAW and employer will make efforts to resolve disagreements or will designate a 3rd MD as per 10 CFR 850
(4) Does the plan require that when the two physicians are unable to resolve their disagreement, despite the efforts of the responsible employer and the beryllium-associated worker, the employer and the worker, through their respective physicians, designate a third physician to:	
(i) Review any findings, determinations, or recommendations of the other two physicians; and	
(ii) Conduct such examinations, consultations, laboratory tests, and consultations with the other two physicians, as the third physician deems necessary to resolve the disagreement among them.	
(5) Does the plan require that the SOMD act consistently with the findings, determinations, and recommendations of the third physician, unless the SOMD and the beryllium-associated worker reach an agreement that is consistent with the recommendations of at least one of the other two physicians.	The SOMD will act according to the 3rd MD's findings unless another agreement is reached.
(j) Alternate physician determination. Does the plan allow the employer and the beryllium-associated worker or the worker's designated representative to use of any alternate form of physician determination, they agree upon, in lieu of the multiple physician review process provided by paragraph (i) of this section, so long as the alternative is expeditious and at least as protective of the worker?	LLNL does not intend to provide the alternate physician option and will instead provide the opportunity for multiple physician review.
(k) Does the plan require that the SOMD provide the employer a written and signed medical opinion for each medical evaluation performed on each beryllium-associated worker within two weeks of receipt of results, that takes into account the findings, determinations and recommendations of the other examining physicians who may have examined the beryllium-associated worker? The SOMD's opinion must contain:	The SOMD will provide medical opinions for each evaluation within 2 weeks of results. This opinion will include: -diagnosis -medical restrictions or removal -statement that results were explained to the workers, etc.

Section	LLNL References/Comments
(1) The diagnosis of the worker's condition relevant to occupational exposure to beryllium, and any other medical condition that would place the worker at increased risk of material impairment to health from further exposure to beryllium;	
(2) Any recommendation for removal of the worker from DOE beryllium activities, or limitation on the worker's activities or duties or use of personal protective equipment, such as a respirator; and	
(3) A statement that the SOMD or examining physician has clearly explained to the worker the results of the medical evaluation, including all tests results and any medical condition related to beryllium exposure that requires further evaluation or treatment.	
(4) Does the plan specify that the SOMD's written medical opinion not reveal specific records, findings, and diagnoses that are not related to medical conditions that may be affected by beryllium exposure.	The SOMD's medical opinion will not include any information unrelated to Be exposure.
(l) Information provided to the beryllium-associated worker.	The BAW will receive a written opinion summarizing clinical findings within 10 working days.
(1) Does the plan require that the SOMD provide each beryllium-associated worker with a written medical opinion containing the results of all medical tests or procedures, an explanation of any abnormal findings, and any recommendation that the worker be referred for additional testing for evidence of CBD, within 10 working days after the SOMD's receipt of the results of the medical tests or procedures.	
(2) Does the plan require that the employer, within 30 days after a request by a beryllium-associated worker, provide the worker with the information the responsible employer is required to provide the examining physician under paragraph (a)(6) of this section.	The employer will provide designated information within 30 days of request by the BAW.
(m) Reporting. Does the plan require that the employer report on the applicable OSHA reporting form beryllium sensitization, CBD, or any other abnormal condition or disorder of workers caused or aggravated by occupational exposure to beryllium.	All Be sensitized persons are now being reported via the standard LLNL/OSHA injury reporting process.
(n) Data analysis.	
(1) Does the plan require that the employer routinely and systematically analyze medical, job, and exposure data with the aim of identifying individuals or groups of individuals potentially at risk for CBD and working conditions that are contributing to that risk.	Medical exposure and data will be routinely analyzed to establish prevalence rates in order to identify individuals and groups at risk of sensitization.
(2) Does the plan require that the employer use the results of these analyses to identify additional workers to whom	The results of these analyses will be used to identify additional workers in need of

Section	LLNL References/Comments
the responsible employer must provide medical surveillance and to determine the need for additional exposure controls.	surveillance or exposure controls.
§ 850.35. Medical Removal	See Section XV of the LLNL CBDPP.
(a) Medical removal protection. Does the plan have provisions for the medical removal from exposure to beryllium of a beryllium-associated worker if the SOMD determines in a written medical opinion that it is medically appropriate to remove the worker from such exposure?	Medical removal will be done upon recommendation of the SOMD or his designee.
(b) Does the plan discuss the criteria on which the SOMD's determination must be based and do they include:	The clinical criteria outlined in the rule will be used by the SOMD to determine need for medical removal.
(1) on one or more positive Be-LPT results,	
(2) chronic beryllium disease diagnosis,	
(3) an examining physician's recommendation, or	
(4) any other signs or symptoms that the SOMD deems medically sufficient to remove a worker.	
(c) ©Temporary removal pending final medical determination. Does the plan:	Temporary medical removal will be done if the SOMD determines it is appropriate based on review of clinical and exposure data.
(1) Provide for temporary medical removal of a beryllium-associated worker from exposure to beryllium on each occasion that the SOMD determines in a written medical opinion that the worker should be temporarily removed from such exposure pending a final medical determination of whether the worker should be removed permanently. The term "final medical determination" means the outcome of the multiple physician review process or the alternate medical determination process provided for in § 850.34.	
(2) Include provisions for the transfer of beryllium-associated worker is temporarily removed from beryllium to a comparable job for which the worker is qualified (or for which the worker can be trained in a short period) and where beryllium exposures are as low as possible, but in no event at or above the action level.	
(3) Indicate that the removed beryllium-associated worker's total normal earnings, seniority, and other worker rights and benefits will continue as if the worker had not been removed.	LLNL's employment policy will be updated to accommodate the new DOE rule. Provisions for job transfer with comparable earnings, seniority benefits, etc. will be included as per the rule.
(4) Indicate that when a comparable job is not available, the removed beryllium-associated worker's total normal earnings, seniority and other worker rights and benefits will continue, as though the worker had not been removed, until a job becomes available or for one year, whichever comes first.	

Section	LLNL References/Comments
(d) Permanent medical removal. Does the plan:	
(1) Indicate that a beryllium-associated worker must be offered permanent medical removal from exposure to beryllium if the SOMD determines in a written medical opinion that the worker should be permanently removed from exposure to beryllium.	Permanent medical removal provisions will also be made in accordance to the rule.
(2) That a beryllium-associated worker removed permanently from beryllium exposure, based on the SOMD's recommendation pursuant to this section, the responsible employer must provide the worker the medical removal protection benefits specified in paragraph (b) of this section.	
(e) Worker consultation before temporary or permanent medical removal.	The worker will be offered a consultation prior to temporary or permanent medical removal.
(1) Does the plan require that the SOMD do the following for a beryllium-associated worker temporarily or permanently removed from exposure to beryllium:	Adequate medical and regulatory information will be provided to the worker and questions answered in accordance to the rule.
(i) Advise the beryllium-associated worker of the determination that medical removal is necessary to protect the worker's health;	
(ii) Provide the beryllium-associated worker with a copy of this rule and its preamble, and any other information the SOMD deems necessary on the risks of continued exposure to beryllium and the benefits of removal;	
(iii) Provide the beryllium-associated worker the opportunity to have any questions concerning medical removal answered; and	
(iv) Obtain the beryllium-associated worker's signature acknowledging that the worker has been advised to accept medical removal from beryllium exposure as provided in this section, and has been provided with the information specified in this paragraph, on the benefits of removal and the risks of continued exposure to beryllium.	
(f) Return to work after medical removal.	
(1) Does the plan indicate that a beryllium-associated worker who has been permanently removed cannot be returned to the worker's former job status unless the SOMD first determines in a written medical opinion that continued medical removal is no longer necessary to protect the worker's health.	A BAW who has been permanently removed cannot be returned unless the SOMD decides removal is no longer necessary to protect the workers health. The SOMD will fully discuss circumstances.
(2) Does the plan require that, when a removed the beryllium-associated worker's health is no longer at risk from continued exposure to beryllium and medical removal is no longer an needed, the SOMD:	
(i) Fully discuss circumstances with the worker and	

Section	LLNL References/Comments
(ii) Then, in a written determination opinion, the SOMD, may authorize the responsible employer to return the worker to his or her former job status?	
(iii) There after, is the returned beryllium-associated worker provided with medical surveillance.	
(g) Medical removal protection benefits.	
(1) Does the plan require that a beryllium-associated worker who has been permanently removed from beryllium be provided:	
(i) The opportunity to transfer to another position which is available, or later becomes available, for which the beryllium-associated worker is qualified (or for which the worker can be trained in a short period) and where beryllium exposures are as low as possible, but in no event at or above the action level; or	
(ii) If the beryllium-associated worker cannot be transferred to a comparable job where beryllium exposures are below the action level, a maximum of 2 years of permanent medical removal protection benefits.	Two years of benefits will be provided where the worker cannot be transferred to another job which is consistent with the requirement of the Rule.
(2) Do the plan's medical removal protection benefits require that the removed worker's total normal earnings, seniority and other worker rights and benefits continue as though the worker had not been removed?	
(3) Under the plan, do medical removal protection benefits continue pending disposition of a removed beryllium-associated worker's compensation claim for workers' compensation payment for a beryllium-related disability? The responsible employer must receive no credit for the workers' compensation payments received by the worker for treatment related expenses.	Benefits will continue pending disposition of a removed BAW Workers Compensation claim for Be related disability.
(4) Does the plan allow the reduction of medical removal protection benefits to a removed beryllium-associated worker by the amounts the worker receives in compensation for earnings lost during the period of removal either from a publicly- or employer-funded compensation program, or from employment with another employer made possible by virtue of the worker's removal?	The program will follow University of California procedures with respect to adjustment of benefits under its benefits programs.
(5) Does the plan the provision of medical removal protection benefits upon the beryllium-associated worker's participation in medical surveillance?	The plan will provide such benefits

Section	LLNL References/Comments
§ 850.36 Medical consent.	See Section XVI of the LLNL CBDPP.
(a) Does the plan specify that each beryllium-associated worker will be provided a summary of the medical surveillance program at least one week before the first medical evaluation or procedure or at any time requested by the worker? Does this summary must include:	Each BAW will receive an offer letter that describes the Be surveillance program and addresses each issue listed in 850.36 specifically data collected and maintained, purpose of data use, protection of data, etc.
(1) The type of data that will be collected in the medical surveillance program?	Information on risks and benefits of tests and clinical evaluations will
(2) How the data will be collected and maintained?	Be provided at least 1 week prior to any such evaluation or test.
(3) The purpose for which the data will be used?	
(4) A description of how confidential data will be protected?	
(b) Does the plan that each beryllium-associated worker be provided information on the benefits and risks of the medical tests and examinations available to the worker at least one week prior to any such examination or test, and an opportunity to have the worker's questions answered?	Prior to testing, each beryllium worker and BAW is required by LLNL to attend a medical Briefing at which the benefits and risks of medical testing are presented and questions are answered.
(c) ©Must the SOMD obtain a beryllium-associated worker's signature on the informed consent form found in Appendix A to this part, before performing medical evaluations or any tests?	The SOMD or designee will obtain the Be worker's signature on the informed consent form prior to performing any evaluations or tests.
§ 850.37 Training and counseling.	See Section XVII of the LLNL CBDPP; only the counseling-specific aspects of the Rule are addressed in this Appendix.
(f) Does the plan include the development and implementation of a counseling program to assist beryllium-associated workers who are diagnosed by the SOMD to be sensitized to beryllium or to have CBD? Does the counseling program must include communicating with beryllium-associated workers concerning:	A counseling program is being planned. It will be implemented by Health Services Dept. to assist sensitized and CBD workers with concerns re medical treatment, counseling, benefits, worker's comp, work practices, and risks of continued Be exposure. All sensitized workers will be
(1) The medical surveillance program provisions and procedures;	Encouraged to make use of these services.
(2) Medical treatment options;	
(3) Medical, psychological, and career counseling;	
(4) Medical benefits;	
(5) Administrative procedures and workers rights under applicable Workers' Compensation laws and regulations;	
(6) Work practice procedures limiting beryllium-associated worker exposure to beryllium; and	
(7) The risk of continued beryllium exposure after	

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sensitization.	
§850.39 Record Keeping & Information	See Section XIX of the LLNL CBDPP; only the medical-specific aspects of the record keeping are addressed in this Appendix.
(a) Does the plan require the establishment and maintenance of accurate records of all:	
(1) beryllium inventory information,	
(2) hazard assessments,	
(3) exposure measurements,	
(4) exposure controls, and	
(5) medical surveillance	
(b) Does the plan require that these records be retained for a minimum of seventy-five years?	Records will be maintained to the standards specified in 850.39. Worker confidentiality will be preserved to the extent afforded by law. Be records will be stored in patient charts in Health Services, medical records.
(c) Does the plan specify that all required records will be conveyed to DOE or its designee all record if the employer ceases to be involved in the CBDPP.	
(d) Does the plan require that workplace conditions and health outcomes be data linked to establish a basis for understanding the beryllium health risk?	
(e) Does the plan ensure the confidentiality of all work-related records generated under this rule by ensuring that:	
(1) All records that are transmitted to other parties do not contain names, social security numbers or any other variables, or combination of variables, that could be used to identify particular individuals; and	
(2) Individual medical information generated by the CBDPP is:	Individual medical information generated at LLNL under this rule will be maintained in a confidential medical record.
(i) Either included as part of the worker's site medical records and maintained by the SOMD, or is maintained by another physician designated by the responsible employer;	
(ii) Maintained separately from other records; and,	
(iii) Used or disclosed by the responsible employer only in conformance with any applicable requirements imposed by the Americans with Disabilities Act, the Privacy Act of 1974, the Freedom of Information Act, and any other applicable law.	
(f) Does the plan require that all records required by this part be kept in current and accessible electronic systems, which include the ability readily to retrieve data in a format that maintains confidentiality?	*Records will be kept in current and accessible electronic systems
(g) Does the plan specify that the transmission of required	*Transmission of records to DOE Office of

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records to the DOE Assistant Secretary for Environment, Safety and Health, when requested, will be in a format that protects the confidentiality of individuals?	Epidemiological Studies will be done semiannually.
(h) Does the require the semi-annual transmission, to the DOE Office of Epidemiologic Studies within the Office of Environment, Safety and Health, of an electronic registry of beryllium-associated workers that protects confidentiality, and the registry must include, but is not limited to, a unique identifier, date of birth, gender, site, job history, medical screening test results, exposure measurements, and results of referrals for specialized medical evaluations.	
§ 850.40 Performance feedback.	See Section XX of the LLNL CBDPP; only the medical-specific aspects of performance feedback are addressed in this Appendix.
(a) Does the plan require periodic analyses and assessments of monitoring activities, hazards, medical surveillance, exposure reduction and minimization, and occurrence reporting data?	Medical surveillance data will be periodically assessed.
(b) Does the plan require that the results of periodic analyses and assessments be given to line managers, planners, worker protection staff, workers, medical staff, and labor organizations representing beryllium-associated workers who request such information.	